COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS FOR 2018

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

HOUSE OF REPRESENTATIVES

ONE HUNDRED FIFTEENTH CONGRESS

FIRST SESSION

SUBCOMMITTEE ON COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES

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COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS FOR 2018

THURSDAY, MAY 25, 2017.

DEPARTMENT OF COMMERCE

WITNESS

HON. WILBUR ROSS, SECRETARY, U.S. DEPARTMENT OF COMMERCE

Mr. CULBERSON. The Commerce, Justice, and Science Subcommittee will come to order. We want to welcome our witness today, Commerce Secretary Ross. We deeply appreciate your service to the nation and are grateful to you and everyone at the Department of Commerce for the job that you do. Today we are going to discuss the Department of Commerce's fiscal year 2018 budget request.

Secretary Ross, we anticipate this will be a very tight budget year for the subcommittee and the Congress. We are all going to have to work to find efficiencies and fund the most important programs. I hope, Secretary Ross, that you can bring some of your innovative cost-saving ideas from the private sector to the Commerce Department to help us make this department save our constituents' very precious, scarce, and hard-earned tax dollars. You have proposed a lot of funding reductions across the department. We will take a close look at all of them and see what makes sense.

The Department of Commerce has several important missions, including preparing for and conducting the Decennial Census, enforcing our nation's trade laws, forecasting the weather, managing our fisheries, protecting and exploring our oceans, and administering our patent and trademark laws. The budget proposes reshaping the Commerce Department to focus on the highest priority missions. With the limited resources available to the committee, we will work to make sure that you are appropriately addressing the most important key priorities, such as ensuring that the 2020 Census will cost less than the 2010 Census; making certain that weather satellite programs meet their cost and schedule timelines; and strengthening cyber and IT security at the department, an ongoing and serious problem in the 21st Century.

Before we proceed, Mr. Secretary, I would like to recognize the gentleman from New York, Mr. Serrano, for any opening statements he would like to make.

Mr. SERRANO. Thank you, Mr. Chairman. And I want to join you in welcoming the Commerce Secretary. Mr. Ross, I just want to know, is this the hearing that we were supposed to conduct all in Spanish? Not this one?

Mr. CULBERSON. That is the one tomorrow.

Mr. SERRANO. Tomorrow? The Department of Commerce is vital in promoting job creation and opportunity for all. In doing so, it must ensure that we have fair trade in which American workers are protected and well compensated. As part of that effort, we must also make sure that other countries enforce labor laws and environmental regulations that help us combat climate change, the very things that undermine fair trade if not done correctly. In addition, the Department promotes sustainable development and improves standards of living by working in partnership with numerous stakeholders.

The President's budget request for fiscal year 2018 includes $7.8 billion for the Department of Commerce, which is a $1.4 billion, or 15 percent, decrease from the 2017 enacted level. This level of funding endangers these core missions at the Department. This budget very foolishly eliminates, in my opinion, vital agencies and zeroes out important programs.

For example, it eliminates Economic Development Administration Grants and the Minority Business Development Agency. EDA is the only agency across the Federal Government that focuses exclusively on economic development in economically distressed areas around the nation. In addition, MBDA promotes the growth of minority-owned businesses and helps them compete in the world economy. I strongly oppose the elimination of these two agencies because it will hurt small businesses, workers, and economically distressed areas.

The President's budget blueprint for 2018 also seeks to zero out funding for the Manufacturing Extension Partnership, or MEP. It is estimated that for every one dollar of Federal investment the MEP national network generates $17.90 in new sales growth for manufacturers, and $27 in new client investment. A survey by the Upjohn Institute in cooperation with the MEP centers showed that the MEP program helped create and retain more than 80,000 jobs in 2015 alone. In short, this program enhances the productivity and competitiveness of small and medium-sized manufacturers, and creates well-paying jobs while reducing our trade deficit with other countries.

In addition to these cuts, the Trump administration proposes to zero out funding for various NOAA grants and programs that support coastal and marine management, and education and research, and benefit industry as well. States and local stakeholders are also involved. The Regional Coastal Resilience Grants, for instance, ensure our states and communities are prepared to face changing ocean conditions, from acidification to sea level rise, as well as major catastrophes. We need to make sure that we help our coastal areas. We need to make sure that we help our coastal communities remain resilient in the face of climate change and allow NOAA's research programs to continue. This is necessary for America's economic and environmental health.

With regard to the Census Bureau, a very important constitutional mandate. As I stated a couple of weeks ago at our hearing with Director Thompson, the proposed funding level falls short of what is needed to help ramp up the ongoing preparations for both the 2020 Census and the other important surveys conducted by the Bureau. In fact, your requested total is actually $136.6 million below President Obama's request for the previous fiscal year. Underfunding and delays in the enactment of the Bureau's budget have already had consequences, and I remain seriously concerned that the Bureau will not be able to match the historic levels of compliance from the 2010 Census. This is a critical time for the Census Bureau, and the leadership vacuum in combination with this budget request imperils a successful Decennial Census.

These proposals in total represent the betrayal of many of the very individuals who voted for President Trump, individuals who reside in areas that are hurting economically and that are greatly helped by the programs that this budget seeks to eliminate. However, Mr. Chairman, I remain confident, and I want to say this to you personally because of our relationship, that I mean this sincerely, I and my staff want a bipartisan approach, want to be able to do the best for the Commerce Department. Because if they succeed, America succeeds. So there will be times when we disagree. It may fall apart. Who knows? It is democracy. But my intent is to work with you to come up with a bill that we can be proud of. Thank you.

Mr. CULBERSON. We have always worked together beautifully and we are starting in the right place. I look forward to finding the way to do that in the weeks ahead.

It is my privilege to recognize the gentleman from New Jersey, our full committee chairman, Mr. Frelinghuysen, for any remarks he would like to make.

The FRELINGHUYSEN. Well, thank you, Chairman Culberson, and welcome, Secretary Ross, to the Appropriations Committee. Today's hearing is an important part of the oversight duties of the committee and now we have formally received the administration's budget, and I can assure you we will go through each and every budget, including yours, line by line, question witnesses, your good self, and other representatives of the department and demand credible spending justifications. And only then will we make our own determinations on the best use of tax dollars.

The Department of Commerce of course serves as a voice of America's businesses. And in my home State of New Jersey your department plays an integral role in promoting job creation and creating more economic opportunities. It is imperative that we continue to make smart investments that protect American companies from unfair trade practices, help foster and grow domestic manufacturing, and promote U.S. innovation and industrial competitiveness, and deliver more U.S. products to international markets.

In a larger sense, many of my colleagues are concerned that certain sections of your budget suggest that America may be stepping back from many of its international relationships and responsibilities. I for one am concerned about the optics of a possible retreat into isolationism and protectionism. What I do know, and I think we all know, we cannot isolate ourselves and expect the vacuum not to be filled by the Chinese and others. We have seen that in the military aspect of what we are doing in the Middle East. If you step back, the vacuum is filled by bad characters who will take that economic edge away from us.

But we are very pleased to have you here this morning and I thank Chairman Culberson for the opportunity to address you. Thank you.

Mr. CULBERSON. Thank you, Mr. Chairman. Secretary Ross, we are delighted to have you here today. And your written statement will be entered into the record in its entirety, if there is no objection. We recognize you for your opening statement. And if you could keep your statement to within five minutes, that would be appreciated. Thank you, sir.

DEPARTMENT OF COMMERCE FY 2018 BUDGET OVERVIEW

Secretary ROSS. Thank you, Chairman. Chairman Culberson, Ranking Member Serrano, and members of the House Appropriations Subcommittee, I thank you for this opportunity to discuss President Trump's fiscal year 2018 budget request, a New Foundation for American Greatness. And thank you all for your previous support of the Department of Commerce.

When I was confirmed as Secretary of Commerce on February 27th, I took on the great responsibility of ensuring our Nation's taxpayer dollars are targeted to our current mission for keeping us safe and creating economic growth. The President's 2018 budget request is $7.8 billion in discretionary funding for Commerce, is a first step towards achieving those means. Oh—it is on. Were people able to hear what I had been saying or do I need to start back—it seemed to me like everybody was following. Anyway, the President's budget request prioritizes and protects investment in core government functions. These include ensuring fair and secure trade, preparing for the 2020 Decennial Census, and providing the satellites necessary to produce timely and accurate weather forecasts. The budget also reduces or eliminates often duplicative or redundant grant programs.

The administration is devoting resources toward making critical investments in our Nation's economic and military security. The President's budget provides an additional $4.5 million to the International Trade Administration for its Enforcement and Compliance Operations. These resources will be directed towards the self-initiation of anti-dumping and countervailing duty investigations. We will ensure that no country or foreign corporation can take unfair advantage of U.S. markets. This budget will create 29 new positions to accelerate these cases and shield U.S. businesses which are concerned about retaliation.

The President's budget also provides a $1 million increase in funding for the Bureau of Industry and Security (BIS). The requested funding will add 19 new special agents within BIS' Export Enforcement Offices across the United States. BIS, despite its current size of only about 120 special agents, pushes far above its weight in defense of our country.

In March, we announced a combined civil and criminal fine of $1.19 billion against ZTE Corporation, the second largest Chinese telecommunications company, for illegally shipping sensitive equipment to Iran and North Korea. BIS took the lead in cracking this case open. So I am confident that these 19 additional agents and the bandwidth they represent will have real impact.

The President's 2018 budget also requests $1.5 billion for the U.S. Census Bureau, a two percent increase from the 2017 Omnibus Appropriations. This is a recognition of the important work that the Department of Commerce does in fulfilling its constitutional responsibilities of the Executive branch. The President's budget funds key activities that prepare for the 2020 Decennial Census and in support of the Bureau's other data collection functions.

As you are well aware, the Census Director has reported a large cost overrun in one area of its operations. The Commerce Secretariat and the OMB are jointly cross-checking these numbers. In addition, we are retaining outside consultants to conduct a third party review. We hope to have more clarity on this issue soon.

The 2018 fiscal year budget also proposes $4.8 billion for the National Oceanic and Atmospheric Administration. NOAA's budget is tailored to fund its core missions of data collection and environmental stewardship. Within NOAA's top line, $1 billion is recommended for the National Weather Service. Funding is also included for the Advance Weather Interactive Processing System Cyclical Refreshment. This reduces the risk of system downtime that can impede critical weather forecasts and warnings. With its $1.8 billion request for the National Environmental Satellite and Data Information Service, NESDIS, NOAA will continue its work to deploy the next generation of weather satellites.

These items are just a small cross-section of our department's overall budget. I hope that I have given you a glimpse into the priorities set by President Trump and his administration. I am glad for the opportunity to get into more detail with you and to provide answers for any specific questions you may have. Thank you.

Mr. CULBERSON. Mr. Secretary, thank you. I want to commend you for the focus, as you indicated in your testimony, on the International Trade Administration. We are delighted to be joined by our ranking member, the gentlewoman from New York. I would be pleased to recognize her for any statement she would like to make at this time.

Ms. LOWEY. Well, thank you very much. And I am really excited to see you again, and I wish you the best in your new responsibilities. And I thank you so much for joining us today.

As you noted in your written testimony, the Department of Commerce's mission is to ensure that taxpayer dollars go to programs that will grow the economy, and that is why your budget's elimination of the Economic Development Administration, which helps struggling communities, does not make any sense. And I hope we can have further discussion on that.

I would say that investments in scientific and environment advancements that keep our coastal zones and marine wildlife safe also have an important economic impact. Given this administration's aversion to science, unfortunately, especially when it comes to climate change, your proposed eliminations of the NOAA National Sea Grant Program and the NOAA Coastal Zone Management Grant Program may not be a surprise, but combined with significant decreases to NOAA climate research and NIST, these cuts are dangerous. We need research to understand the changes in the environment and weather patterns that put our communities' safety and economies at risk. An ounce of prevention is worth a pound of cure. I could name a litany of natural disasters for which we could have been better prepared to mitigate damage. Superstorm Sandy, for example, destroyed homes, businesses, transportation hubs, and shorelines along the eastern shore, including in my district. The Federal Government provided $60 billion to help communities recover and rebuild. Why in the world would we impede research to help us understand and prepare for the havoc our changing environment could wreak on our communities in both lives and treasure?

Finally I must note while this budget includes an increase for the Census Bureau, it is shockingly insufficient with 2020 looming. We need an accurate and full picture of the population to understand how to best serve the American people across every Federal department and agency.

Mr. Secretary, I look forward to a productive discussion this morning, and I look forward to working with you to achieve the Department's goals. And Mr. Chairman, I want to thank you so much. As the chairman knows, we have had our roller skates on today, there are so many hearings. Thank you very, very much for giving me the opportunity.

Mr. CULBERSON. Thank you, Ms. Lowey. Delighted to have you with us and it is always a pleasure to work with you.

Mr. Secretary, I truly do want to thank you for focusing on anti-dumping and countervailing duties. And I want to congratulate the department in particular for that long overdue and very important $1 billion civil and criminal fine that was imposed on ZTE. That is extraordinarily important. The Chinese have been notorious in this area and I am really grateful to you for that work. And I congratulate the agents in the department that took care of that.

Secretary ROSS. Thank you, sir.

CENSUS

Mr. CULBERSON. If I could, Mr. Secretary, start with the Census. We had a hearing earlier this month with the Census Bureau and they testified that their IT systems would be 48 percent over budget, which is unacceptable. What will you do to hold Census employees and contractors accountable for that cost breach, and what steps are you taking to keep the cost of the 2020 Census under control while reserving your ability to perform that vitally important function?

Secretary ROSS. Surely. Well the first thing we are trying to do is to get our arms around what the real numbers are likely to be. We have put together a task force consisting of folks from the Secretariat and from OMB, plus two outside consultants with a great deal of experience in prior Censuses so that we can begin to identify what caused the huge overrun that has already been reported and what are the implications for potential future further overruns. Because that was just one segment that accounted for it.

In general, the contracts that the Census Bureau has put out have tended to be time and material contracts. My experience in the private sector has been when you have a very complicated situation with a large number of vendors and the necessity to integrate them into a very massive software activity, the potential for trouble is really quite considerable. It is alarming that at this relatively early stage when only a small portion has actually been spent, they already are calculating for a very major overrun on the back end of it.

We are going through the entire series of activities that will be conducted as we keep two things in mind. One deals with the budget course or budget requirements, and second, which is outside the parameters, has to do with how bad could it get if really things get totally out of control? Once we have those two, we have to determine what can be done on a remedial basis in each of the various phases to bring the current situation back under control.

Our primary objective, though, is an accurate enumeration of the population and we do not intend to sacrifice that at all. If it is going to cost more, we will come to you, we will explain why, and we will work with you on solutions.

I am just getting up to speed on all these contracts, because, as you know, they were entered into before I was confirmed as the Secretary of Commerce. So other than those 40,000-foot observations for the moment, we will get to ground zero and we will report quite promptly once we do.

Mr. CULBERSON. I have faith you will get to the bottom of it. I want to assure you that I will work with you, and this committee will work with you, to be sure that you have the tools you need to hold people accountable and to do what is necessary to help control the cost of the Census while ensuring its accuracy. That is a vitally important role of the Department.

We are expecting votes about 11:30. So I am going to cut my time a little short, 11:15, 11:30, and recognize Mr. Serrano so we can move along.

Secretary ROSS. Yes, sir.

Mr. CULBERSON. Thank you, sir.

Mr. SERRANO. The President's budget request includes $800 million for the 2020 Census preparations. But while this is an increase above the current level, it is still $131 million below the amount that the Commerce Department had earlier projected to be needed for fiscal year 2018. The Department is now planning on delaying the opening of regional offices and other issues that we need to set up. Mr. Secretary, how can such an inadequate budget request for the 2020 Census be justified? And will it not eventually lead to a situation where the Census in fact will cost more? And how can we fix that? Because as you know, the Census is one of the few areas which is constitutionally mandated. We need to do it, and we need to get a good count. It helps all the states. It helps all our members. But we do not seem to be ready to do it, nor do we seem to be able to pay for it properly. And secondly, having a vacuum at the leadership position also adds to the problem.

Secretary ROSS. Well, that is a whole bunch of questions, sir. I will try to answer them as best I can.

I am committed to being transparent, totally transparent with this committee regarding the financial requirements of the 2020 Census. And as soon as we really have a good handle on the 2020 Census requirements, whether it is more or less, whatever it is going to turn out to be, we will promptly come back to you with our detailed backup for why we are making the request. So rest assured of that.

Rest assured, also, I have a historic reason for being very interested in the Census in that when I was working my way through Harvard Business School, I was a Census taker. I literally was an enumerator with the big white belt and the badge going around Copley Square in Boston. So I understand the groundwork that is needed to be done. I also understand how hard it is to manage that kind of a workforce. You are talking about hiring hundreds of thousands of part-time people, who know they are part-time, and who also know that there is no permanent career opportunity for them at Census. So just creating, hiring, and managing that kind of a force, all over the country, and in the territories, dealing with Native American Reservations, it is a very, very daunting and very complex task. So I do not think I will be underestimating the magnitude of either its importance or the magnitude of its challenges. But as we sit here at this moment, I do not have a totally reliable figure for you. When I return it will be an amount that I can stand behind.

Mr. SERRANO. OK. Mr. Chairman, do I have enough time for another question?

Mr. CULBERSON. Thank you. Yeah, but we are going to try to follow the five minutes.

INVESTIGATION OF RUSSIAN INTERFERENCE IN THE 2016 PRESIDENTIAL ELECTION

Mr. SERRANO. Well, this is a longer question. Mr. Secretary, I have a number of questions about the administration's budget request. But before we get to that, I need to address something related to the cloud that is currently hanging over much of the Federal Government right now. And that is the investigation into Russian interference in the 2016 Presidential Election.

Earlier this year numerous members of Congress sent you written questions related to the Bank of Cypress and its Russian investors. First, why has the White House refused to permit the release of your written responses to these questions? Second, are you concerned that the White House refusal to release your answers contributes to the concern expressed by many Americans over the White House refusal to address the testimony by current and former intelligence officials that Russia did in fact interfere in the 2016 elections?

Secretary ROSS. Well, I am aware of the letters that were sent by various members of Congress. I discussed that as part of my confirmation proceedings. What the White House decision making was, I cannot tell you why. But that was the position.

Rest assured, though, the New York Times, which is not normally a big friend of this administration, did a very thorough investigative study of my own situation vis à vis Bank of Cypress and Russia, and they came away with a very affirmative conclusion in terms of me not having any real involvement. So I hope that gives you some degree of comfort in the situation.

Mr. CULBERSON. Thank you, Mr. Secretary. Chairman Frelinghuysen.

The CHAIRMAN. In my earlier life I was in Mr. Serrano's position as the ranking. It is better to be in the majority situation, I think.

Let me say, I commend you for taking a look at the Census. It really begs the question, what has been going on over there since the last Census? I mean, it is an expensive endeavor and I think much of American business obviously depends on a lot of the information that is collected. I know you are acutely aware of that. And lastly, I would like to put a plug in. I have always thought that NOAA has done an incredible job. I am reminded of, what is it, 71 percent of the world's surface is water. So it is important that we be aware of all aspects that relate to it. And I want to put a plug in for NIST. Sometimes in the overall scheme of things, there are a lot of acronyms, but they do some remarkable things, too. And I have always viewed it as sort of one of the crown jewels that is out there, especially now because they have this sort of initiative on cyber which I think affects just about every part of our Nation. But certainly you know that in the final analysis this House is going to put its imprint on your recommendations. And we obviously will do that respectfully and look forward to working very closely as we move ahead. Thank you, Mr. Chairman.

Secretary ROSS. Thank you, sir.

Mr. CULBERSON. Ms. Lowey.

NOAA SEA GRANT PROGRAM

Ms. LOWEY. Thank you very much. And where our Chairman left off, I would like to say that I look forward to working with the Chairman and all my colleagues in producing a really good bill, as we did in 2017.

So to my question, Mr. Secretary, you are proposing to eliminate the NOAA Sea Grant Program, which received $63 million in the recently-passed fiscal year 2017 spending bill. Its national network of colleges and universities conducts scientific research in support of the conservation and practical use of the coasts, the Great Lakes, and other marine areas. There are several universities and research institutions in our home State, New York, that are part of this network—in fact, I would love to take you at some point to Columbia University's Lamont-Doherty Earth Observatory—but so are a number of universities in other states that voted for President Trump because they believed that he would deliver for their economies: Ohio, Wisconsin, Michigan, Florida, North Carolina, and others. If the Sea Grant Program is eliminated, as President Trump proposes, these states will lose this very valuable program. This does not make sense to me and if you would comment on this, I would really be appreciative, and I would love to take you to Lamont-Doherty one day.

Secretary ROSS. Well if permitted by the Office of Government Ethics, I will take you up on your invitation to go there.

In terms of the substance of it, the administration's 2018 budget prioritizes rebuilding the military and making critical investments in the Nation's security. It also identifies the savings and efficiencies needed to keep the Nation on a responsible fiscal path. To meet those goals, some difficult decisions needed to be made. The administration prioritized programs that provide a good return to the taxpayer, as well as those that serve the most critical functions while consolidating or eliminating duplicative, ineffective, or less critical programs.

NOAA'S Sea Grant Program is a successful program. But it is one that primarily benefits industry, State, and local stakeholders. Those programs are a lower priority than the core functions maintained by the budget, such as surveys, charting, and fisheries management.

Ms. LOWEY. Let me just say that I look forward to having you visit this program, because although some wisdom may come from some in the administration, I think that analysis is misguided. Because if you look at the creation of jobs, the Sea Grant Program is absolutely key. So thank you very much, and we will move on and I will save my other questions for another day. But we really have to analyze each of these programs. And the person who briefed you may not be aware of the job creating opportunities and the knowledge we gain from these outstanding programs. So I look forward, I will take you up on your acceptance. Thank you.

Secretary ROSS. Thank you.

Mr. CULBERSON. Thank you, Ms. Lowey. It is my privilege to recognize the chairman of the full committee in the last Congress, and former chairman of this wonderful subcommittee, the gentleman from Kentucky, Mr. Rogers.

ITA ENFORCEMENT AND COMPLIANCE FOR STEEL

Mr. ROGERS. Thank you for being here. Congratulations on your elevation to this post, or demotion as the case may be. So good luck to you.

Recently, U.S. steel companies have had to close plants and lay off their employees at an alarming rate due to unfair trade practices. In December of 2015, AK Steel temporarily laid off about 700 employees at Ashland, Kentucky, just outside my district. And AK Steel pointed out that one of the reasons for that temporary lay off was, "the onslaught of unfairly traded imports." AK and several other domestic steel producers filed a complaint with the International Trade Administration and the International Trade Commission at Commerce. And in 2016, Commerce imposed a 209 percent duty on imported Chinese corrosion-resistant steel and leveraged separate anti-dumping duties on hot rolled steel products from seven other countries. And then in March of this year, ITC determined that countries under de facto Chinese government control had in fact sold stainless steel sheet in the U.S. at far less than market value, injuring U.S. companies. And they imposed a 58 percent duty on these Chinese products.

But the AK Steel plant is still idling, its Ashland furnace, as are many of the other steel companies. In recent years, this committee provided several funding increases for the ITA Enforcement and Compliance Division. I am pleased to see that the President's request in his budget continues this trend with an additional $3 million.

[The information follows:]

"Clarification: There are two requested increases for Enforcement and Compliance: 1) $3.9 million for strengthening current programs, and 2) $4.5 million for Self-Initiation of Anti-Dumping/Countervailing Duty Investigations and Administration Reviews"

The question is, how do you plan to spend that money and stop this insidious wasting of American jobs?

Secretary ROSS. Thank you, sir. Well as you are probably aware, I have spent a good deal of time in the steel industry myself, with International Steel Group and Bethlehem Steel and LTB and some others. So I am acutely aware of how we got to where we are.

What we are doing is a number of things. We have stepped up the pace of enforcement. Already the department has almost 400 orders, I think it is around 389 or 390, about half of which alone relate to steel. And about half of those relate to Chinese as one of the participants. So we are very much focused on both the geography and the magnitude of the problem. And just yesterday we held a hearing under Section 232 exploring the national defense and national economic security implications of the steel situation. It was a very, very interesting day. We had 37 separate witnesses come to testify, Steel Worker's Union, just about all the American steel producers, some of the consuming industries. And interestingly several representatives of foreign governments, the Chinese Government, the Russian Government, Ukrainian Government, and maybe one or two others testified that they did not feel that there was any national defense or economic security implication to steel. Representatives of our domestic industry by and large took a quite different view.

We have been studying this industry within the department for quite some time since the executive order. Having completed the hearing, we have allowed another week for written submissions beyond those that have already come in. Once we have had a chance to review yesterday's oral testimony, plus the written, we will complete our report. Also, we will recommend to the President whatever course of action the facts suggest. And then he will make his decision. We technically have 270 days to complete this report. We are not going to take anything like that. Sometime during the month of June I expect we will render the report. My guess is the President will act very quickly on the report once it is submitted.

Mr. ROGERS. Well as the gentleman knows, steel is the backbone of American industry. So many other types of industries feed off it, such as coal in my district.

Secretary ROSS. Right.

Mr. ROGERS. And of course others. So we wish you well in your job and in pushing these proposals to stop this insidious wasting of American jobs. We want to make steel great again.

Secretary ROSS. Yes, sir. Well steel is very important to our national defense. Even though it is only a small percentage of total steel production, it is the same mills that make steel for civilian purposes that make it for military purposes. The famous big bomb that was let loose in Afghanistan would not have been able to do the job without a lot of steel. Neither would the Navy have ships, neither would the Air Force have planes, neither would the Army have tanks or armored personnel carries, or rifles, or anything. So steel, is an essential ingredient to many of our industries and products. Particularly, the higher quality special alloys are extremely important from the point of view of armor, armor for vessels, armor for vehicles, armor for everything. So we are focusing quite intently on it. And the questions we posed to the people who testified yesterday were, one, do they agree that it is a national emergency? Two, if it is, what is it we should do? Should a tariff be imposed? Should it be quotas? Should it be some combination of the two? Should it be broadly based, covering a multitude of steel products? Should it be more narrowly focused? How should we deal with the relationship in steel between the U.S. and its two immediate neighbors, Canada and Mexico? We actually have steel surplus with Canada and Mexico. So that puts them in a little different position, as well as the fact that they are participants in NAFTA.

So my reason for going into that detail is this is a very serious situation and it is the first systematic study of the real implications of the import problem, the global over capacity on steel. And that will be followed up very shortly with our response to the President's other executive order about aluminum. We are going to be conducting a very similar study on aluminum. And there may well be other industries that need the same treatment. If it comes to an affirmative finding, Section 232 gives the President very broad powers as to the kinds of remedies that he might impose. So that is one of the merits of using that very rarely used provision in the 1962 Act. So we are on board with that investigation.

But we are not letting up on the normal enforcement matters. In fact, recently, we did a case called Tenaris in which the problem was not steel as such—am I over time?

Mr. CULBERSON. They just called a vote, Mr. Secretary.

Secretary ROSS. OK. My goodness.

Mr. CULBERSON. Excuse me, but we have a vote. Forgive me for interrupting because you are talking about something we are all in agreement on, focusing on the strategic importance of our steel industry and protecting it in the United States. Mr. Cartwright, if you can be brief we will recognize you. We will then recess and come back, Mr. Secretary. Excuse me for interrupting you.

ECONOMIC DEVELOPMENT ADMINISTRATION

Mr. CARTWRIGHT. Thank you, Mr. Chairman. Secretary Ross, welcome to our subcommittee. I am Matthew Cartwright from Northeastern Pennsylvania. My hope is that you share my commitment to the goal of creating and preserving family sustaining jobs in our economy. Something that is horribly troubling to me is that the administration proposes the complete elimination of the Economic Development Administration, the EDA, one of our greatest job creators in this Nation. I believe if anything we need to expand the work of the EDA to help the communities that need it most. For example, the past two budget proposals from the administration included a power plus plan, which would focus money on communities that have been hurt by the contraction of the coal communities.

I am proud to be the lead Democrat on a bill called the Reclaim Act, introduced by the former chairman, Representative Hal Rogers here, and Senator McConnell, a brilliant piece of legislation that would inject $1 billion to benefit those communities. Mr. Secretary, will you support the Reclaim Act and similar efforts to inject funding and help create jobs where they are needed most?

Secretary ROSS. The administration is committed to bringing jobs back and to building jobs here in existing businesses. And I very,

very much share his commitment to those activities. And a lot of the reason why we have become so much stricter in enforcement than had been true before, is that is where a lot of the problems are coming from, is from dumping of product.

You have, take the steel industry, a global over capacity that has set the unused excess capacity is several times that of total U.S. consumption. So it dwarfs our whole economy. So we really need that.

MANUFACTURING EXTENSION PARTNERSHIP

Mr. CARTWRIGHT. Well thank you for that. I want to move on to manufacturing, which I think is one of the keys——

Secretary ROSS. Yes, sir.

Mr. CARTWRIGHT [continuing]. To creating and preserving family sustaining jobs. Mr. Secretary, the administration proposes eliminating all Federal funding to the Manufacturing Extension Partnership, the MEP, as was originally intended when the program was established, they said. But in 1998 Congress changed course and has continued to appropriate funding for MEP in every single subsequent year in strong bipartisan fashion.

MEP centers need Federal support because they serve manufacturers that are too small to attract private sector investment. Over 60 percent of MEP beneficiaries cite MEP centers as their only resource for technical expertise.

Now my question is a full 85 percent of Department of Defense awards go to smaller manufacturing firms. This is the very market the MEP program serves. Have you analyzed the potential threat to DOD's manufacturing and readiness needs if you eliminated the program that allows DOD suppliers to be more productive, efficient, and innovative?

Secretary ROSS. Well as I mentioned, this budget unfortunately has to be about priorities. And the MEP has certainly performed a good function. We believe that even with the elimination of Federal funding the MEP centers would transition to non-Federal revenue sources, which as I understand it, was originally intended when the program was first established, that it would eventually transit to non-Federal sources.

Mr. CARTWRIGHT. Could you be specific on what the plan is for transitioning to non-Federal sources?

Secretary ROSS. Well they have partnerships with a number of local institutions. We believe that there is community support for funding coming from private sector to them. We certainly do not mean to imply that manufacturing is not critical. It is. We understand that. But you have to make difficult choices when you are in a stringent budget and unfortunately this is one of the choices that had to be made.

Mr. CULBERSON. We are running pretty tight.

Mr. CARTWRIGHT. I yield back, Mr. Chairman.

Mr. CULBERSON. Thank you. Thank you very much, Mr. Cartwright. I recognize Judge Carter.

CYBERSECURITY

Mr. CARTER. Secretary Ross, welcome. Thank you for being here. I chair the DHS Subcommittee on Appropriations and I often hear about threats we face concerning cybersecurity. And actually the outright theft of intellectual properties and the growing cyber threat we face concerning our critical infrastructure, such as the grid. Tell us about what changes you are making in the cybersecurity realm to protect our critical infrastructure. And have, we have seen general nods to increase cybersecurity and tightening of intellectual property security in the budget, how can American business, especially small and medium enterprises, expect to see these initiatives working for them?

Secretary ROSS. Well as you know, part of the Department of Commerce's function is to take a leading role in the interagency activities relating to cybersecurity. That is a problem that I think will be with us for the rest of our lives and our grandchildren's lives. It is a never ending struggle to try to keep pace with or even get a little bit ahead of the hackers. You saw this very recent instance on a huge, huge scale.

So this is a very serious problem. We take it very seriously. And I feel that the work that the people within Commerce are doing is very, very valuable to it. I think they are acknowledged as playing a leadership role, along with Homeland Security, along with other entities of the government in doing so. And they will continue those efforts. We are very, very supportive of that.

Mr. CARTER. Do you feel like that small businesses and medium sized businesses are being considered? Because we know that the targets and the big target areas out there are, make the news. But the reality is, those smaller entities have less ability to secure their own information.

Secretary ROSS. No——

Mr. CARTER. And it would seem to me that would be something that you would have to be challenged by.

Secretary ROSS. Yes. That is certainly true. It is also true, though, that at least some of the hackers are more interested in getting blackmail money or protection money. And so they tend to go after the larger targets because there is a bigger check that they can get for the same hacking. So it is a problem for small businesses. And it is something we are very aware of. So is the Small Business Administration, Administrator Linda McMahon is aware of it as well. It just is a struggle we are going to have every day as we go forward. And we are doing the best we can to cope with it.

Mr. CARTER. Thank you, Mr. Chairman.

Mr. CULBERSON. Thank you, Judge. Mr. Secretary, I think we will recess at this time because the vote is down to the last three minutes. There are three votes, so I do not expect to be too long. We will come right back into session. So with that, the committee stands in recess. Thank you, Mr. Secretary.

Secretary ROSS. Thank you, Chairman.

[Recess.]

Mr. CULBERSON. The hearing will come to order.

Ms. Meng, you are next. If I could, I would like to briefly recognize our ranking member, Mr. Serrano, for a brief statement.

Mr. SERRANO. Mr. Secretary, don't be shocked, but I am going to praise you for something. [Laughter.]

I have been in Congress 27 years and you are the first Secretary to mention the Territories, I was born in Puerto Rico, without having to be prodded by me to mention the Territories. [Laughter.]

So I appreciate that personally. Thank you.

CENSUS DIRECTOR

Secretary ROSS. Thank you, Congressman.

Mr. CULBERSON. Mr. Serrano is a true gentleman.

Ms. Meng, I am pleased to recognize you.

Ms. MENG. Thank you, Mr. Chairman.

Thank you, Mr. Secretary, for being here today, and congratulations as well.

I wanted to follow up on questioning about the census. As you know, Director Thompson recently retired from the U.S. Census Bureau; where are you in the process of hiring a new director?

Secretary ROSS. Well, we have been actively recruiting and we would welcome any suggestions that members of this committee might have as to who would be a good successor. We are looking both within Census and outside Census to try to find both the Director and the Deputy Director.

MINORITY BUSINESS DEVELOPMENT AGENCY (MBDA)

Ms. MENG. Thank you.

My other question is about the MBDA. Your budget submission to Congress proposes eliminating the MBDA. It is the only Federal agency tasked to create new jobs by expanding the U.S. economy through our Nation's 8.1 million minority businesses. Based on current census data, it is estimated that by the year 2050 minorities will represent 54 percent of the total United States population. Minorities currently represent 29 percent of our population, but own only 7.5 percent of our Nation's businesses.

How can we ensure if this agency is eliminated that we are giving them opportunities to grow?

Minority-owned businesses are twice as likely to export their products and services, for example, as non-minority-owned businesses.

My questions are, what message does the elimination of a program like this send to our minority communities across America, and how will this administration ensure that for minority-owned businesses that they have a level playing field in access to capital, contracts and markets?

Thank you.

Secretary ROSS. Thank you. That is a very important question. The administration's general focus is trying to help everybody in the economy with the tax reductions, with the regulatory reductions, with unleashing our energy resources, and with getting rid of inappropriate trade practices. Our hope is that that will make a much better environment for all businesses, whether minority businesses or not.

As to the MBDA itself, it is a relatively small entity, as you are aware, and a grant-making entity, and in general those have been targets in this budget proposal. Small, grant-making entities have been targeted. And part of the reason is there is some duplicative activity between the MBDA and the Small Business Administration in their district offices and in their small business development centers.

But the President's proposal to eliminate the agency should not be viewed as an abandonment of the agency's core mission. Rather it is in a strange way an acknowledgment that the agency has succeeded in creating an environment that is more supportive of minority businesses today than it had been before the agency was founded in 1969.

So in a sense that is a factor in it, but our hope is that the overall lift to the economy will make a lot more room for minority businesses and other small businesses.

Ms. MENG. Thank you for that.

As you know, the SBA programs would address small businesses, not all minority-owned businesses are necessarily small businesses. I am just concerned and would love to hear more details. And I appreciate you addressing issues like tax regulations and cutting down on regulations. I am just concerned if the MBDA is eliminated, and the 30-plus centers around the country are eliminated, then the employees won't be there in certain communities to be able to help minority communities. Outside of the SBA, if businesses don't fit into that category, how are we going to ensure that the core mission of the MBDA is fulfilled?

Secretary ROSS. Well, as you know, there also are similar efforts at the State and local, as well as private sector efforts to encourage minority business development, presumably those will go unabated by the demise, if it occurs, of the MBDA.

Also, you probably are aware, I serve on the board of OPIC and of the Export/Import Bank and I have been encouraging those two institutions very aggressively to help smaller businesses and particularly minority businesses, because only two percent of all American businesses ever export anything. And I think part of the reason is, it is a daunting challenge to arrange foreign transactions, letters of credit, all the things that are essential to the international market place. So I have been trying to get them to focus more on the small business situations in this country.

Ms. MENG. If I could just finish by saying, if I could work with you and have your commitment on ensuring that our government is fulfilling the core mission of the MBDA as we work through this budget, and is working with the State and local governments to make sure they have the resources that they need.

Secretary ROSS. Surely. Well, we had to make a lot of difficult decisions in this budget process and this was one of the more difficult ones.

Mr. CULBERSON. Thank you, Mr. Secretary.

I know the University of Houston has a very successful program to coach and guide minority business owners and small businesses into the equity market. Also I know you have got 55 years of experience in this area.

Secretary ROSS. Yes, sir.

Mr. CULBERSON. So it is an area you know well.

Secretary ROSS. Yes, sir.

Mr. CULBERSON. I want to recognize Mr. Palazzo.

NDAA-COMMERCIAL AND RECREATIONAL FISHING

Mr. PALAZZO. Thank you, Mr. Chairman. And, Mr. Secretary, thank you for being here today.

Mr. Secretary, having been at least a part-time Florida resident, I think you understand very well that commercial and recreational fishing in State and Federal Gulf of Mexico waters is very important to the national and our regional economies. And as everyone here knows, NOAA announced earlier this month that the recreational fishermen along the coast would have a mere three days to fish for red snapper in Federal waters. Over the past decade, the recreational private sector has seen annual seasons reduced from 194 days in 2007 to just 11 days in 2016, to three days in 2017.

Now, I am not going to get in the weeds on this one with things like total allowable catch or State versus Federal data collection. I think my Gulf Coast colleagues and I have outlined those issues fairly extensively at this point in the several letters that we have sent you and your department in 2017.

I understand that in the absence of legislation the agency's purview is limited; however, going forward can you assure us that you will use whatever tools you have to provide some relief to our recreational anglers right now and down the road work with Congress to develop a long-term solution to address these issues impacting our recreational fishermen and coastal communities.

Secretary ROSS. I am quite aware of the situation and those letters sent by some 15 Congressmen on the topic led by Majority Whip Steve Scalise, and just last night Earl Comstock from my office, who is our Director of Policy, had a meeting with many of those members. I don't know, Mr. Palazzo, if you were——

Mr. PALAZZO. Yes, sir, I was in attendance.

Secretary ROSS [continuing]. Part of it. I think there he pledged and I pledge again that we will try to make sure that there is an equitable solution to the conundrum of recreational fishing versus commercial fishing. But you are quite right in saying that our resources in the sense of powers is relatively limited in that area.

So we are going to be making a very fulsome request of NOAA for the underlying data on which they base the decision just to give that one three-day weekend for recreational red snapper catching. It seems on the skimpy side, but we are not the fish experts. So I promise you we will follow up and we will do the best we can to balance the needs of the recreational with the needs of the commercial.

Mr. PALAZZO. Well, Mr. Secretary, I appreciate that, and I look forward to working with you and your team to help the recreational anglers be able to enjoy what pretty much, you know, is their heritage and what they enjoy to do, and be able to get out on the waters and make memories that will last a lifetime.

So thank you, sir.

Secretary ROSS. Well, when I was a little boy, my grandfather and I used to fish a lot. So I have a history as a recreational fisherman.

Mr. PALAZZO. And you never forget those memories.

Secretary ROSS. Thank you.

Mr. PALAZZO. Thank you.

Mr. CULBERSON. Thank you, Mr. Secretary. I want to express my agreement with Mr. Palazzo. This is a thorny issue. Red snapper is a tough issue. But three days are on the skimpy side. And the commercial fishermen have done a good job, the stocks are rebounding because there were reasonable limits put in place to protect red snapper. There has certainly to be a way to open up the Federal waters to recreational fishermen in a way that will preserve the fishing stock. Maybe just limits in the Federal waters like you have got in the State waters.

Secretary ROSS. Sure. Well, the fishing whole scene is very intriguing to me in that I am obsessed with the problem that we have a $13 billion deficit, trade deficit in fish and fish products, and it doesn't seem to me with all the water surrounding us and all the lakes and rivers, it seems weird that we should have a deficit. So that is one of the areas we are going to be focusing very much on.

It is not directly on the point of recreational, but the whole fishing topic is very, very complex and fascinating.

Mr. CULBERSON. And especially important in the United States, as you say, with our coastal waters are so prolific. We have done a good job of protecting and managing those assets and there are few people in Congress that know more about it than the former State Senator from Washington, Mr. Kilmer. We look to him and Mr. Palazzo for advice on this.

ECONOMIC DEVELOPMENT ADMINISTRATION (EDA)

Mr. KILMER. Thanks. Thanks for being with us, Mr. Secretary.

Before I came to Congress, I worked in economic development professionally, and I worked often with the only agency at the Federal level whose sole purpose is economic development and that is the Economic Development Administration.

I represent a district that has a lot of areas that are really struggling. My hometown of Port Angeles is one of those distressed communities and with the help of the EDA's Regional Innovation Strategies Program just started up a composite recycling center in that town with an investment of just $500,000, which is a drop in the bucket for the Federal government. The recycling center is going to establish a new industry and bring much-needed jobs into an area that needs it. And I am perplexed that the department would choose to eliminate one of the Federal government's strongest supporters of job creation.

I know that the rationale is stated as it being duplicative. I guess I would love to understand what programs is the EDA duplicative of and what is the rationale for eliminating it.

Secretary ROSS. Well, thank you for that question.

First of all, I am proud of the investments that the EDA has made historically. I think their record over the last 52 years has been exemplary both in terms of the help they have provided to distressed regions and of the way that the investments have turned out. I think it has been a very well-run program because there were locally driven strategies and needs that it succeeded as well as it did. Those investments did spur local innovation and entrepreneurship, saved jobs and leveraged private investments.

Now, the good news about the decision is that there will be a continuity of the administration of the grants, because there is a large portfolio. There are approximately 1,400 grants outstanding that total $1 billion. So there is going to be a several-years during which those grants will be administered and that therefore will assure at least that the existing grantees are not left out in the cold; there will still be the relationship with them.

Mr. KILMER. So who is going to fill the gap afterwards?

Secretary ROSS. There are other programs that at the State level and at the local level in a variety of communities that perhaps could fill some of that gap.

COASTAL ZONE MANAGEMENT AND REGIONAL COASTAL RESILIENCE GRANTS

Mr. KILMER. Just in the interest of time, I will move on. I mean, I would just say I think communities like the one where I grew up are looking to the Federal Government to be a partner in those efforts.

Other areas that are looking to be partners are coastal communities. I represent the coast of Washington State. And, you know, I know you have a long background in business and can appreciate return on investment. The Coastal Zone Management Program and the Regional Coastal Resilience grants are good examples of return on investment.

And in your own budget justification it says, "Over the 45-year history of the Coastal Zone Management Program, participating States and Federal agencies have partnered to streamline permitting and regulatory processes, reduce the costs associated with disasters, and address environmental risks with potentially catastrophic economic impacts." By the most modest standard, they say that there has been more than three-to-one return on investment.

I represent a district that is already dealing with the impacts of more severe storms, with sea level rise, with coastal hazards, including potential tsunami. So I have to say the elimination of these programs I think would be very pound foolish, I can't even say it is penny wise.

You know, I know our own chairman from Texas, you know, there are 27 refineries representing 29 percent of the Nation's refining capacity in Texas, some of them are on the coast, a lot of them are. Countless ports. We have a lot of defense installations that are on the coast. Forty percent of the U.S. population lives in coastal areas. These programs actually help make our communities safer; they help us protect critical infrastructure, they help us shore up those national security assets.

So can you explain to me and to our subcommittee why you believe NOAA's Coastal Zone Management and Coastal Resilience Programs should be eliminated? Because I have to be honest, the justification that is in the budget I just don't find compelling at all.

Secretary ROSS. Well, again, to get to the administration's priority goals, which were rebuilding the military and making critical investments in national security, there had to be an identification of savings that could be made in order to keep the Nation on a responsible fiscal basis and, unfortunately, that requires some very difficult decisions to be made.

I certainly agree with you, there is nothing inherently wrong with Coastal Zone Management, it is not a criticism of the functions that they had performed, but you have to cut somewhere and it seemed to us to be something of a lower priority than the core functions of NOAA such as the surveys, the charting, and the fisheries management activities that they have. So it was a question of trying to rank priorities rather than any editorial comment against Coastal Zone Management.

Mr. KILMER. I would just mention, I think the Defense Department does a stupendous job of keeping us safe, but so do programs like this; they keep coastal communities safer.

Thank you, Mr. Chairman.

NOAA SATELLITES

Mr. CULBERSON. Thank you. I know we do record—you know, the deficit is at tremendous levels, the military really does need to be shored up. I have heard, you probably heard the numbers, about the Marine aviation. Marine airplanes cannot be flown because of inadequate spare parts, about half of the Navy's planes are having difficulty staying in the air because of a lack of spare parts. We really do have a critical problem with the Nation's military at a time of a crushing national debt that we just can't pass on to our kids.

So it is going to be a really difficult budget year for all of us. We are going to have to really work hard to be sure that our constituents' very scarce and hard-earned tax dollars are wisely spent and targeted. With your experience in banking and equity, we look to your guidance on how we can shift minority business, small business, and coastal community programs we see laid out in the President's budget, over to the private sector.

An area that is also of concern, in terms of managing precious and scarce hard-earned tax dollars, is in NOAA's weather satellites. NOAA's three biggest weather satellite programs are slated to cost nearly $30 billion over the next 15 years. They are absolutely essential to the Nation's economy, to protecting lives, to ensure that we can accurately forecast the weather, but this $30 billion price tag is quite frankly going to put intense pressure on the rest of the department's budget.

As we move forward, Mr. Secretary, what options are you examining to reduce the cost of the weather satellite program while maintaining accurate and reliable forecasts?

Secretary ROSS. Well, clearly the number-one purpose is the accuracy and the reliability of the forecasts. So we don't want to compromise those activities at all.

One of the things we are looking into is NOAA has done a good thing buying in bulk and getting some savings in the cost of satellites. Satellite is not like Navy fighter planes or Air Force planes where it is a big, long program that is going to go many, many years. These are pretty much a custom designed, very limited market, and they have found that by bunching together a couple of purchases they get a much cheaper price than they would have to pay if they just ordered one and then a couple years from now ordered another one, and their statistics on that are pretty compelling.

So even though it seems strange to order a thing years before you will actually need to use it, they make a very good case that that actually does save, because the amortization of the special designs now goes over more than one unit rather than just have to be recovered in one single unit.

What we are discussing with them, though, is what are the implications of the fact that the satellite lives now appear to be about six years longer than had previously been forecast, but what are the implications that that has for how much duplication do you really need, how much overlap do you really need. And we are trying to get our arms around that so that we can get a more precise thing.

So it is good news that the lives are proving to be longer, because even if nothing else changes that will mean a longer period when we are safe, we are going to have proper forecasts. But they are on schedule for the September, 2017 launch, that is going to happen, and they appear to be within their budget for that one.

Currently there doesn't seem to be a big economic overrun. The latter satellite is being postponed to 2023, so there is a little gap there. But I do think that they have done a pretty good job figuring out in what unit increments to make the orders so that they do minimize the price.

You also, of course, have to be aware that there is a need for some redundancy, because there is always the danger of a catastrophic failure and while that may only be a one or two percent probability, if it happens then it is a hundred percent probability. So that is a tricky thing for them to balance and so far it feels as though they are doing a pretty good job of it.

Mr. CULBERSON. And since the GEO satellites are lasting longer, should we slow the pace of buying more GEO satellites if the existing ones are lasting longer?

Secretary ROSS. Well, that is exactly the question I was just raising. That is something we are exploring with them, but there still is the danger of the catastrophic failure. There is also the danger of a launch failing. Now, they have not really had that, but as you have seen some of the private sector, SpaceX for instance, have had some severe problems with launches.

So it is a very complicated question and my work so far with them has suggested they are doing a pretty good job balancing all of these variables.

MINORITY BUSINESS DEVELOPMENT AGENCY

Mr. CULBERSON. Thank you, Mr. Secretary.

Mr. Serrano.

Mr. SERRANO. Thank you. To follow up on these questions, Mr. Secretary.

As you know, the Minority Business Development Agency was established by a Republican president, President Richard Nixon. This agency received 34 million dollars in the final fiscal year 2017 Appropriations Act. This is a successful program with locations around the Nation, including in my district, yet the administration seems intent upon destroying it.

In his signing statement on the Appropriations Act that we just concluded, President Trump asserted that the provisions of this agency's appropriations would be treated, quote, "in a manner consistent with the requirement to afford equal protection of the laws under the due process clause of the Constitution's fifth amendment," unquote.

Would you please explain this? In what ways will the Department depart from the approach of previous administrations of both parties as far as implementation of the funding for the development agency? And secondly, did the White House or OMB officials consult with you in advance about the President's signing statement?

Secretary ROSS. As I said, it is not meant to be an editorial comment on the quality of the agency or the performance that it has had over the years. It simply is a question there is a limited amount of funding, very, very difficult decisions had to be made, very uncomfortable decisions. And we had to cut somewhere and this seemed to be something that did not destroy the fundamental missions of the Commerce Department.

In an ideal world, we certainly would have preferred to keep it going, but we are in a stringent budget period.

Mr. SERRANO. I am aware of that, Mr. Secretary, but my question further is, if you agree that in an ideal world we could keep it going, then what harm could it cause once we remove it, you know?

Secretary ROSS. What harm could it cause once we remove it?

Mr. SERRANO. When we remove it, you said that you don't see that it is a—it sounded to me like you say it is not that important to the ongoing operation of the Commerce Department, but yet it has value and a lot of people——

Secretary ROSS. It does have value, there is no question about that. But what we are trying to do is to improve the whole economy for everyone and by reducing taxes, curtailing inappropriate imports, unleashing the energy, all those measures are designed to make the economy better for everyone.

So what we are trying to do on a macro scale is make less the necessary functions on a micro scale to help things. If the economy gets stronger overall, businesses will thrive.

CENSUS

Mr. SERRANO. Let me move on to another area, Mr. Secretary.

Again, we go to the census. The budget requests to save money, proposes to save money, by scaling back several of the Census Bureau's most widely used surveys. For example, the budget would reduce the sample size of the Survey of Income and Program Participation, or SIPP.

Now, the census collects a lot of information that a lot of Americans I think look at and say why did we ask that question, and yet it really is necessary because it speaks to who we are as a Nation, what we are as a Nation, what we have, what we don't have. You know, when we say the average American has, whatever, three television sets or so on, that wasn't just made up, you know, there are people who work at that.

Why get rid of that or scale back the SIPP part of the form? Of the study, if you will.

Secretary ROSS. Well, the census, are you addressing the issue of the content of census?

Mr. SERRANO. Yes.

Secretary ROSS. It is my understanding that there was a hearing in the Congress, a different committee from this one on content, and that the final content of the census will be determined by next spring. I don't believe there has been a final determination as to what will be the content of the items, the questions asked.

What complicates it, though, is that the more questions you ask and the more subcategories within those questions the lower the response rate tends to be, because people don't want to put an infinite amount of time to dealing with the census questions. So there is a balancing attempted between having maximum content and getting maximum response, because we are clearly better off to the degree we can get actual responses rather than interpolated or estimated responses.

So it is also a balancing act between a response percentage and content.

Mr. SERRANO. I would just close this question by saying that I hope as a person of your background you keep an eye on this, because this is more important than we think. This gives us or I have been told by Census Directors before it gives us indications on economic trends and on situations that we need to know also.

Secretary ROSS. True.

Mr. SERRANO. As you know, I am sure you know, we work a lot with census information to make decisions. The best decision, I think, or the worst is that is how they redraw our districts, but we are not going to discuss that painful one right now. [Laughter.]

Secretary ROSS. Well, over the years I have been a very big consumer of data put out by the census, so I have a great deal of respect for it. I am very happy that they have done a lot of things to improve the accuracy of the preliminary forecasts versus the revised ones, because the preliminary forecasts are getting better and better as they find more and more reliable data sources on a timely basis.

So I have a very keen appreciation of the importance of the census data and I think they are the gold standard in the world for accuracy and for the breadth of content that they provide. I don't believe there is another country that does the census at all as well as we do either in terms of breadth of content or accuracy.

THE DEPARTMENT OF COMMERCE AND CUBA

Mr. SERRANO. One last question, Mr. Secretary.

I have spent a lot of time in my 27 years here talking about a new relationship with Cuba, and we do have a new relationship, but it is not on the front page anymore, so a lot of people are wondering what that relationship is. Is the Commerce Department involved in any way in opening up Cuba and opening up the U.S. to Cuba in a way that we didn't do before?

Secretary ROSS. Well, as I understand it, so far there have been a number of hotel chains from the U.S. that have made arrangements to operate facilities in Cuba and that is probably one of the best things for that economy in that it used to be a very big tourist economy, and then obviously that changed quite considerably during the difficult periods.

So I think that has been the number-one initiative so far is the tourism initiative. And there has been consultation between the travel industry and parts of Commerce on a very, very active basis. That is the main thing of which I am aware at this point.

Mr. SERRANO. Thank you, Mr. Secretary.

Mr. CULBERSON. Thank you, Mr. Serrano.

Mr. Cartwright.

NOAA—NATIONAL WEATHER MODEL

Mr. CARTWRIGHT. Thank you, Mr. Chairman.

Secretary Ross, while the administration's general position on the cause of our changing climate flies in the face of science, we can agree that the Earth is warming and extreme weather events are occurring with more frequency. 2016 was the warmest year on record and out of the last 17 years fully 16 of them have been the warmest on record to date.

Now, specific to your mission, sir, new scientific analyses find that the Earth's oceans are rising nearly three times as fast as they did during the 20th Century. Sea level is not only real and an imminent threat, but it is accelerating.

NOAA, the National Oceanic and Atmospheric Administration, has been gathering and analyzing climate and weather data since 1970. I appreciate that during your confirmation hearing you said in regard to climate science that science should be left to the scientists, I can't tell you how much I appreciated hearing that. But the administration's budget proposal significantly decreases the funding that allows these scientists to do their essential work. You can't leave the work to the scientists, but not give them the resources they need to do that work.

My first question relates to the administration's call for a 52-percent decrease in funding for its National Water Model, NWM. The NWM has proven significantly to improve flood forecasting. Now, with heavy downpours increasing across the Nation, the need for accurate and timely flood forecasting is more important than ever. Why does the budget proposal reduce flood forecasting, which can help save lives and money, Secretary?

Secretary ROSS. Well, you are right that the National Water Model has been reduced. Fiscal year 2017 was at $6 million, fiscal year 2018 it was planned to be at $2.9 million. And the Regional Climate Center, fiscal year 2017, $3.65 million; fiscal year 2018, $650,000. These are level-of-effort activities. No centers are being closed. It was an affordability decision, not a policy decision.

NOAA—REGIONAL CLIMATE CENTERS

Mr. CARTWRIGHT. You anticipated my next question, which is the RCCs, the Regional Climate Centers. Actually, the administration's budget request is an 82-percent cut to the RCCs.

Now, these have been around for more than 30 years, helping local communities on the ground work with National Centers for Environmental Information's data records and apply them to solving many real-world problems posed by climate change. Businesses and farmers rely on this information, the RCC data; what are they going to do when you cut this funding? Your budget states that, quote, "With this reduction, NOAA will rely on State and local service providers to cover the necessary services," unquote, and that is a phrase that has been in tone several times in today's hearing.

My to question is, really? Who might it be that steps in and replaces this funding?

Secretary ROSS. Well, as I indicated, no centers are being closed. So there is no region that will be left without a center, it is just the level of activity will be diminished somewhat. And within the levels of activity, they will try to prioritize the ones that are the most crucial.

Mr. CARTWRIGHT. Well, if the implication is we are going to push it off on the states, states have a State climatologist who generally has a very limited budget, and these State climatologists typically share and receive information with the RCC——

Secretary ROSS. Right

Mr. CARTWRIGHT [continuing]. Especially for regional concerns that affect larger tracts of geography than just one State.

So again, who are these State and local service providers who can apparently fill the funding gap that you are creating?

Secretary ROSS. I don't know that they will be able to fill the funding gap, but all that is happening is there is a little lower level of activity in each of these regions, no center is being closed. So the level of activity will go down, will go down considerably, but no one will be left without a center.

Mr. CARTWRIGHT. And I take it that the overall answer comports with what you have been saying today, that the big reason for all of these cuts is that we must cut.

Secretary ROSS. Yes, sir. Yes, sir. We are in a very stringent period and with the big increases in defense and military and national security, cuts have to be made somewhere.

Mr. CARTWRIGHT. I yield back, Mr. Chairman.

Mr. CULBERSON. Thank you, Mr. Cartwright.

We are indeed in an era of $20 trillion in debt and extraordinary annual deficits. We have to find areas where we can save money. I would welcome your suggestions where else we might find savings within our summary judgment, and I appreciate very much your work in that area.

Mr. SERRANO. Not in the Commerce Department. [Laughter.]

Mr. CULBERSON. There is undoubtedly somewhere we can save some money within the Department of Commerce.

Mr. Secretary, I really appreciate your service. I have got a number of other questions that I will submit for the record for you to answer in writing.

Secretary ROSS. Surely.

Mr. CULBERSON. We will submit those to you for your response at a later time.

Above all, I want to thank you for your service to your country and for your time here today. We look forward to working with you to find savings to make sure we spend our constituents' very scarce and hard-earned tax dollars wisely and frugally.

Secretary ROSS. Well, thank you, Mr. Chairman. And thank you, ranking member and Members.

Mr. CULBERSON. Thank you, Mr. Secretary. The hearing is adjourned.

The Honorable John A. Culberson

Subcommittee on Commerce, Justice, Science, and Related Agencies

Questions for the Record

Department of Commerce Budget Hearing

IT Security (Satellite and OCIO)

In recent years, the Department of Commerce has had several troubling IG reports on information security. Reports have found weaknesses across the Department's IT enterprise, from the weather satellites to the Department's core functions.

- What progress has the Department made in addressing the issues identified in these reports?

The CIO recognized the importance of evaluating and resolving the several findings and recommendations identified as issues in the OIG reports. The Department has taken the following steps to address the issues:

ANSWER:

1. Corrective actions in process to manage risks associated with National Security Systems – Five (5) National Security System recommendations were identified in the OIG Final Report OIG-16-040-A, Review of IT Security Policies, Procedures, Practices, and Capabilities in Accordance with the Cybersecurity Act of 2015. Of the 5 recommendations, three (3) remain open and two (2) are resolved. The following Table 1 details the status each recommendation and associated corrective actions.

Table 1 – National Security Systems Risk Management Progress

Cybersecurity Act of 2015, OIG-16-040-A, Review of DOC National Security Systems
Recommendation 1: Develop and implement an IT security policy that governs the national security systems within the Department.
Status: Open. 1. Corrective Action 1 (Completed December 2016): Update DOC ITSPP to cover national security systems. 2. Corrective Action 2 (In Progress): Develop, document, and disseminate national security system IT security policies. (Target Completion Date: September 2018)
Recommendation 2: Conduct an internal review to identify all the national security systems operating within the Department.
Status: Open. 1. Corrective Action 1 (Completed September 2016): Conduct data call to identify deployed and operational national security systems within the Department. 2. Corrective Action 2 (Completed August 2016): OCIO to assume ownership of NOAA national security system. 3. Corrective Action 3 (Completed November 2016): Validate the NSS inventory data call responses. 4. Corrective Action 4 (In Progress): Fully incorporate NOAA national security system hardware and software assets into one of the OS national security systems. (Target Completion Date: September 2017)
Recommendation 3: Develop and maintain an accurate inventory of all national security systems within the Department that tracks information about the security status of each system-including current authorization status, points of contact for the individuals responsible for the security of the system, and information about the status of ongoing assessment of security controls.
Status: Resolved. 1. Corrective Action 1 (Completed December 2016): Conduct initial collection of inventory information for national security systems outside of OS. 2. Corrective Action 2 (Completed March 2017): Review feasibility of implementing a Governance, Risk, and Compliance (GRC) management solution for all DOC national security systems. (e.g., CSAM, RSA Archer, Trusted Agent).
Recommendation 4: Develop corrective action plan(s) to address securing all national security systems within the Department that do not currently have an authorization to operate.
Status: Resolved. 1. Corrective Action 1 (Completed September 2016): Develop a project charter to address securing the three (3) national security systems within OS. 2. Corrective Action 2 (Completed November 2016): Collect artifacts supporting the implementation of the Risk Management Framework and related assessment and authorization documentation for all DOC national security systems. 3. Corrective Action 3 (Completed January 2017): Document and track actions or issues associated with each DOC national security system through system-level Plans of Action and Milestones.
Recommendation 5: Conduct the complete risk management process for all national security systems that currently do not have an authorization to operate.
Status: Open. 1. Corrective Action 1 (Completed December 2016): Complete risk management activities and document assessment and authorization artifacts for national security systems within OS. 2. Corrective Action 2 (Completed December 2016): Conduct initial collection of inventory information for national security systems outside of OS. 3. Corrective Action 3 (Completed March 2017): Conduct risk management process for all DOC national security systems and develop supporting artifacts to support authorizations to operate. 4. Corrective Action 4 (Target Completion date September 2017): Conduct third-party assessments for all DOC national security systems.

2. In our ongoing work we have found that even though a cloud service is authorized by the Federal Risk and Authorization Management Program (FedRAMP), Departmental bureaus must fulfill their shared responsibility to ensure the security of their cloud systems – The Department understands the necessity of the bureaus' to evaluate and implement security measures in addition to those confirmed through the FedRAMP process. In March 2016, the Department released a comprehensive policy, Commerce Information Technology Requirement (CITR) 24 FedRAMP Applicability, to specifically address this concern and establish DOC-specific security requirements in addition to FedRAMP requirements for cloud systems. This policy has resulted in an increased level of rigor being applied to the security of cloud services used by DOC bureaus.

3. ECMO & ESOC – The Department's Enterprise Security Operations Center (ESOC) and Enterprise Cybersecurity Monitoring and Operations (ECMO) are both funded through the Working Capital Fund. The ECMO infrastructure is ready to integrate "High" Systems and there are currently 500 endpoints integrated. The bureaus that own "High" systems endpoints still need to prioritize integration activities in order to meet the Department's goal, with a target implementation date of September 29, 2017. NOAA- Eight (8) recommendations were identified in the OIG OIG-16- 043-A Report on Successful Cyber Attack Highlights Longstanding Deficiencies in NOAA's IT Security Program. Of the eight (8) recommendations, four (4) remain open and four (4) are resolved. (Table 1 above details the status of each recommendation and associated corrective actions).

The CIO will continue to work with rigor and speed to assign, implement and complete actions so findings are tracked and closed. The Audit Action Officers will continue to coordinate responses and facilitate corrective actions with internal contributors of information on resolutions of these recommendations.

- What steps is the Department taking to reduce and retire high-risk security vulnerabilities on the first JPSS Satellite prior to launch? How will the Department ensure all necessary IT Security preparations have been made prior to launch?

ANSWER:

The Joint Polar Satellite System (JPSS) Program has made great strides to ensure the cyber resilience of the new polar satellite system with emerging technology that enables use of enterprise tools to monitor and protect the information technology (IT) components from harm related to vulnerability exploitation. The legacy system components that were the focus of prior audit reports had significant known vulnerabilities; however, these components are in the process of being deactivated. The June 2017 independent testing of the new components for JPSS launch indicated a Moderate level of residual risk, a significant improvement from the High risk level shown in FY 2016, as directed by the Authorizing Officers. Specifically, the improvements are primarily due to deactivating legacy vulnerable components and adding technological improvements to strengthen the system's cyber resilience and data processing reliability in preparation for the JPSS-1 launch. The external penetration testing found no exploitable vulnerabilities, and the internal control testing and examinations demonstrated significant system improvement. While work remains to address any remaining residual risk, the JPSS program has corrective action plans in place to address these concerns and to further reduce cybersecurity risk prior to launch. JPSS has prioritized existing resources to address these concerns, especially in the areas of secure configuration management, patching, and system and information integrity controls. We are confident that before the launch date, the system components will have adequate security implemented to enable a successful mission.

- Moving forward, how do you intend to ensure that all systems across the Department meet the relevant IT Security requirements?

ANSWER:

The DOC employs a multi-layered approach to ensuring IT security requirements are implemented.

The Office of Cyber Security (OCS), within the DOC Office of the Chief Information Officer (OCIO) manages and implements the Department-wide IT security program which comprises the enterprise IT security capabilities: Enterprise Security Operations Center (ESOC), Enterprise Continuous Monitoring and Operations Program (ECMO), the implementation of Department of Homeland Security's (DHS) Continuous Diagnostics and Mitigation program, DHS's cyber hygiene scanning services, development and promulgation of cyber security policies and procedures, monitoring individual Operating Units' (OUs') compliance with DOC requirements, and working with OU IT security programs to facilitate best practices.

DOC's IT Security policies and practices are updated regularly to keep pace with ever-changing threats and vulnerabilities, newly-released federal mandates, as well as best practices and guidance in order to protect DOC information and IT resources. The DOC OCIO maintains authoritative IT security policies and guidance which are conveyed to the DOC OUs to implement. These policies and guidance are developed by leveraging the skill and expertise of IT security specialists across the DOC OUs.

The individual DOC OUs implement the minimum requirements conveyed by DOC, and supplement the DOC minimum requirements with OU-specific measures, as needed, depending on their unique technology and risk environments. The OUs also implement the IT security capabilities made available through DOC IT Security enterprise services, to ensure a minimum level of protection is provided to DOC information and systems. A combination of people, processes, and tools are employed to implement minimum IT security requirements and capabilities across the DOC.

DOC OCIO OCS also regularly conducts oversight and compliance activities to ensure minimum standards are being met. This is done through quarterly FISMA reporting and monthly Personal Identity Verification (PIV) reporting, in addition to internal assessments conducted by oversight bodies in and outside the DOC, including DOC OCS, OIG, and Government Accountability Office (GAO).

In response to the Cybersecurity Executive Order, the DOC has recently developed an Action Plan for the Implementation of the [National Institute of Standards and Technology Cybersecurity] Framework, which describes specific actions the DOC will take to improve IT security measures even further in the forthcoming months.

The NOAA Cyber Security Center (NCSC) provides the infrastructure for the Department's Enterprise Security Operations Center. In addition, the NCSC delivers enterprise services to NOAA's systems including security operations of the NOAA Security Operations Center (SOC), incident response, IT security policy, compliance, oversight and training, continuous monitoring, identity, credential, and access management (ICAM), IT security infrastructure, and IT security project management.

Ocean Exploration

Over 70% of the Earth's surface lies beneath the sea. NOAA's Office of Ocean Exploration and Research accounts for less than 0.4% of the Department of Commerce's budget, and conducts research to evaluate new marine resources, participates in extended continental shelf mapping, and explores the arctic and other areas in the US Exclusive Economic Zone. The Department proposed cutting this program by nearly 46% in fiscal year 2018.

- How would this cut affect the nation's ocean exploration?

ANSWER:

The Department of Commerce's FY18 request of $19.4 million for Ocean Exploration and Research (OER) is consistent with the funding levels requested for the OER program in each of the past 3 years. With these funds, NOAA and OER will continue to carry out missions to evaluate new marine resources, participate in the Extended Continental Shelf (ECS) mapping effort, and explore uncharted and little-known ocean areas. Reductions in the number of missions and mapping efforts will occur, however NOAA will prioritize and focus on the activities that provide the most support for the nation's security, economy, and environmental health.

- What is NOAA's contribution to Extended Continental Shelf Mapping?

ANSWER:

Since 2008, NOAA has led the major interagency Extended Continental Shelf (ECS) mapping effort, and invested $23 million to fund ECS expeditions. To date, as part of the ECS effort, more than 2.4 million square kilometers (926,645 square miles) of the ocean have been mapped in eight regions where the U.S. may justify extensions to the Nation's continental shelf and rights over the resources contained therein, estimated by the International Seabed Authority to be in excess of $1 trillion.

First Net

- In March, FirstNet awarded a 25 year contract to build a $46.5 billion nationwide first responder network. How does FirstNet plan to ensure that the Federal funds in this project are well spent and that there is effective government oversight of this public-private partnership?

ANSWER:

FirstNet is incredibly proud of the public-private partnership deal it struck for public safety and the American public on March 30, 2017. Congress provided FirstNet with $7 billion of funding stemming from Federal Communications Commission (FCC) private sector auction revenues to build, deploy, operate and maintain the Nationwide Public Safety Broadband Network. On March 30, FirstNet awarded the contract to AT&T who committed $180 billion of currently existing infrastructure throughout the country to speed deployment, reduce costs, and increasc economies of scale.

Since its creation, FirstNet has incurred operating expenses from hiring staff, conducting extensive consultation and outreach with states and territories to increase understanding of public safety's needs, and executing the comprehensive Request for Proposal (RFP) process to identify a network partner capable of delivering the best solution for public safety. In its RFP, FirstNet included milestones and targets that AT&T must meet in order to gain access to project funds. In addition, FirstNet may impose financial penalties on AT&T if public safety adoption and other milestones are not met throughout the deployment and operational phases of the project.

As required by law, each year FirstNet undergoes a thorough financial audit conducted by an independent third party and FirstNet has implemented best practices in its own internal audit and compliance procedures, including quarterly meetings of its Compliance Committee. FirstNet also submits a report to the appropriate committees of Congress on an annual basis that details the organization's operations, activities, financial condition, and other information, and FirstNet Board members and employees are available to testify before such committees. FirstNet's financial audits and Annual Reports to Congress are available on its website: www.FirstNet.gov

- How will FirstNet ensure that this system meets the needs of our nation's first responders? How will FirstNet address coverage in rural areas?

ANSWER:

Since 2012, FirstNet has been engaged in consultation and outreach with the 56 states and territories. In Fiscal Year 2016 alone, FirstNet participated in more than 130 association events with the 43-member Public Safety Advisory Committee, more than 140 consultation events with the Governors' Single Points of Contact, and more than 83 tribal meetings spanning from Texas to New York, to Kentucky to Washington, and every state and territory in between. This extensive interaction with first responders in all the different geographical settings of the United States has allowed FirstNet to better understand public safety's needs and the unique public safety communications challenges in each state and territory. FirstNet's engagement with public safety will continue over the life of the project.

Throughout the consultation process, public safety continuously reminded FirstNet of the importance of rural public safety communications. FirstNet included rural milestones in its Request for Proposal to ensure that deployment occurs in rural areas during each phase of the project. Public safety must be able to go wherever they are needed, and FirstNet will continue to push the network into these rural areas throughout the life of the project. AT&T has formed a number of partnerships with rural telecom companies as a result of these rural milestones. A list of these companies will appear in the individual state plans.

- I understand that the FirstNet's goal is to deliver FirstNet State Plans in the fall of 2017, and that governors will have 90 days to assess these plans and determine whether their State will participate in FirstNet. How will FirstNet ensure that States that choose to opt-out are still interoperable with the nationwide system? If a large number of States opt-out, how will that effect of the network?

ANSWER:

If a State chooses to opt-out, it must follow the process outlined by Congress in the Middle Class Tax Relief and Job Creation Act of 2012, 47 U.S.C. § 1442 (e) (2) (the "Act"). The State will have 180 days to conduct a Request for Proposal process. Subsequently, the State must submit its alternative plan to the Federal Communications Commission (FCC). Upon receipt of the plan, the FCC will determine whether the State's alternative plan demonstrates the opt-out State's Radio Access Network (RAN) will comply with the minimum technical interoperability requirements in the FCC's interoperability board report and be interoperable with the nationwide network. Additionally, once a state passes the FCC's evaluation, then the National telecommunications and Information Administration (NTIA) will evaluate the State's alternative plan for ongoing interoperability with the FirstNet network, among other criteria. Finally, the State would then enter into a spectrum lease with the FirstNet and will have to adhere to FirstNet's network policies, including technical and operational requirements, prior to any deployment beginning in the State. Congress placed each of these steps within the Act to ensure that any opt-out State's RAN would be interoperable with the nationwide FirstNet network.

FirstNet was tasked with ensuring the deployment and sustainability of the nationwide network. Accordingly, FirstNet has taken steps to make sure that the network will not only be interoperable as noted above, but also financially sustainable, regardless of whether or how many States choose to opt-out. For example, a State that successfully navigates the opt-out process will be required to make annual payments for use of FirstNet's licensed spectrum in the State based on the value of that spectrum. In addition, revenue gained by an opt-out State in excess of what is reasonably necessary to construct, maintain, operate or improve the State RAN must be remitted to FirstNet to support the nationwide network. The purpose of this approach is to ensure that the public safety across all States have a similar network experience, as well as the sustainability of the network in all States.

- How will the FirstNet lab coordinate with and leverage the investments in existing NTIA and NIST labs, like the Institute for Telecommunication Sciences and the Communications Technology Laboratory?

ANSWER:

FirstNet specifically placed its Chief Technology Officer in Boulder, Colorado, to be close to and ensure coordination with NIST's and NTIA's existing telecommunications laboratories. FirstNet continues to work closely with its Federal partners in all aspects of public safety communications research and development to better equip FirstNet service delivery with current technology, while also preparing for the massive increase in innovative technologies that will be coming.

The NIST Public Safety Communications research Division (PSCR) has been instrumental in assisting FirstNet with the evaluation of various network components and capabilities. PSCR and NIST are also developing technology challenge grants and other mechanisms to encourage innovators to develop the next generation of life-saving public-safety technologies.
On June 12, 2017 PSCR awarded $38.5 million in grants to fund 33 research-and-development projects that are designed to help determine future possibilities in a variety of first-responder communications technologies. FirstNet is happy to have strong relationships with our ground-breaking and innovative Federal partners, and these relationships will contribute to the long-term success of public safety communications.

NTIA's ITS has been working closely with FirstNet to ensure that international standards for LTE equipment include the features needed to meet public safety's communication requirements through technical contributions to and participation in standards bodies such as 3GPP. ITS also has been supporting FirstNet with other research and analysis, including studies of indoor cellular coverage for first responders and ongoing quality of experience research using methods that test parameters of particular importance to public safety, such as speech intelligibility.

Satellites

Last year, I asked GAO to review NOAA's flyout charts, the planned launch and operation schedule for NOAA's multi-billion dollar satellite programs. The Committee uses these documents to understand the budget profiles for these satellites, and ensure we are appropriately investing dollars at the right times. GAO found, among other things, that NOAA's changes to these charts were not always supported by analysis of the satellites' health and availability; and that the charts did not always accurately reflect the program schedules.

- What steps has the Department taken to address GAO's findings and to ensure that the Department is using accurate planning information to support its budget requests?

ANSWER:

In response to GAO and other comments, NESDIS developed clear administrative procedures on the preparation of our flyout charts. The guidance is intended to ensure that future charts are clear in scope and content, consistent from version to version, and documented to explain any

changes. The NESDIS Assistant Administrator signed this guidance in February 2017 and it is available online at:
https://www.nesdis.noaa.gov/sites/default/files/asset/document/npd_1411_01a_flyout_chart_policy.pdf

Consistent with this policy, NESDIS flyout charts began being published in March 2017 to reflect reliability-based extended life estimates for on-orbit constellations. The supporting analyses integrate: (1) reliability data for critical subsystems at the time of manufacture, (2) observed on-orbit performance, (3) comparisons to similar systems on other spacecraft, and (4) tracking of spacecraft consumables including fuel and battery performance. Chart updates are performed on an annual basis. Operational events or programmatic decisions may drive out-of-cycle updates, as outlined in the directive. The web-based flyout charts include a link to pages providing additional performance and analysis details.
The flyout charts are not intended to provide real-time operational status of any NOAA spacecraft, nor are they intended to replace integrated master schedules for satellite acquisition programs. Real-time status of on-orbit assets is found on the Office of Satellite Product Operations (OSPO) website. Flyout charts reflect results of decisions and events.

Spectrum

In the House report accompanying the Fiscal Year 2017 Commerce, Justice Science appropriations bill, the Committee encouraged NOAA to consolidate spectrum holdings where appropriate. As you know, for the last five years the budget request has included a proposal to auction or assign the 1675 to 1680 MHz band of spectrum. Could you provide the Committee with a detailed response on how the Department is preparing to execute this proposal so the FCC can auction this band of spectrum as soon as practicable?

ANSWER:

The 1675-1680 MHz spectrum band is currently used by the National Oceanic and Atmospheric Administration (NOAA) for meteorological satellite and radiosonde (weather balloon) operations. NOAA is currently transitioning radiosondes to a new location in the 401-406MHz band. Sharing this band between the Federal government and commercial advanced wireless service operators might be feasible; however, any proposed sharing of the band should be undertaken with great caution and requires comprehensive upfront analysis to assess the potential for interference, interference mitigation strategies and applicable costs, and weigh risks to determine if interference mitigation measures can be successfully established and validated.

The Department has long recognized and supported U.S. government policy to make spectrum available for commercial use. The Department's National Telecommunications and Information Administration (NTIA) Office of Spectrum Management (OSM) has established deliberative and robust processes and associated research and engineering to improve federal spectrum efficiency and sharing designed to provide a sustainable pipeline of spectrum for commercial use while also ensuring sufficient spectrum is available to deliver critical federal services to the Public. A major contributor is NTIA's Institute for Telecommunication Sciences (ITS), performing radio science research and engineering that informs spectrum management and policy decisions. Accordingly, NOAA worked closely with NTIA to repurpose a total of 20 megahertz of spectrum prior to 2015. In coordination with NTIA, NOAA developed the attached 1675-1680 MHz band sharing study, which was recently approved for funding using Spectrum Relocation Funds (SRF) under the Spectrum Pipeline Act, part of the Bipartisan Budget Act of 2015.

The proposed study outlines the NOAA's planned approach to evaluate and identify methodologies to enable sharing of the 1675-1680 MHz band while continuing successful execution of NOAA's mission to safeguard the Nation. The sharing study will analyze NOAA and other federal satellite broadcast receivers and their operational compatibility with commercial broadband operations. It will assess if, and determine how, the band can be shared while maintaining the capabilities to access meteorological, space weather, and other data necessary to complete their missions, which are also vital for NOAA's mission to protect lives and livelihoods.
The 1675-1680 MHz sharing study should begin in January 2018, assuming receipt of funds as expected in September 2017, and will take up to two years to complete. If it results in the identification of a safe, reliable, and cost-effective strategy to mitigate interference in a sharing scenario, the FCC, in coordination with NTIA, would be able to move forward to auction or assign frequencies by fee for shared access to the band.

Attachment: DOC 1675-1680 MHz PIPELINE PACKAGE-PDF

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of the Chief Information Officer
High Performance Computing and Communications
CHIEF INFORMATION OFFICER

December 7, 2016

Spectrum Relocation Fund Technical Panel
The Office of the Assistant Secretary
National Telecommunications and Information Administration
Department of Commerce
1401 Constitution Avenue N.W.
Washington, D.C. 20230

Dear Mr. Steve Molina, Mr. Ronald Repasi, and Mr. Steve Cahill:

The Department of Commerce (DOC) is respectfully requesting Spectrum Pipeline Act funding for a study to evaluate sharing of the 1675 - 1680 MHz with wireless broadband operations.

This formal Spectrum Pipeline request is for the funding to undertake a comprehensive engineering study to identify spectrum sharing methodologies which increase the ability to share spectrum between DOC National Oceanic and Atmospheric Administration (NOAA) Geostationary Operational Environmental Satellite (GOES) satellite systems and commercial broadband operations while maintaining the capability of federal and nonfederal partners in the weather forecasting and emergency management enterprise to capture the satellite data necessary to complete their missions. Given the importance of the information conveyed within the 1675 – 1680 MHz frequency band and the adjacent 1680 – 1695 MHz frequency band, it is vital that the sharing study examine all the myriad of uses comprising the functionality of this band to ensure the continued successful execution of ongoing critical missions.

If you have any questions, please contact me at 301-713-9600 or Zachary.goldstein@noaa.gov ; or contact the engineering, policy, legal, and budgetary leads specified in the plan, with a cc to me.

Thank you for your consideration of this request.

Best regards,

Zachary G. Goldstein

SPECTRUM

PIPELINE REQUEST

1675 – 1680 MHZ ENGINEERING STUDY

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SRF SPECTRUM PIPELINE PACKAGE (1675 MHz – 1680 MHz)

1 EXECUTIVE SUMMARY

Spectrum sharing is becoming an increasingly important method of increasing spectrum use efficiency and availability across both government and commercially allocated spectrum. With business in the U.S. increasingly being conducted via wireless devices, the Department of Commerce (DOC) fully recognizes the importance of effective and efficient spectrum use and sharing in the support of increased U.S. economic growth. It is for this reason, that the DOC is requesting the funding to undertake a comprehensive engineering study that will provide definitive results that will enable the DOC to make objective decisions based upon technical facts and data to increase the functionality and the ability of the DOC to accommodate spectrum sharing with non-federal entities.

The goal of this proposed engineering study is to identify spectrum sharing methodologies which increase the ability to share spectrum between DOC National Oceanic and Atmospheric Administration (NOAA) Geostationary Operational Environmental Satellite (GOES) and other federal satellite Earth stations (includes both fixed and mobile receivers) and commercial broadband operations while maintaining the capability of federal and nonfederal partners in the weather forecasting and emergency management enterprise to access NOAA data necessary to complete their missions. With the importance of the information conveyed within the 1675 – 1680 MHz frequency band and the adjacent 1680 – 1695 MHz frequency band, it is vital that the sharing study examine methods and technologies to ensure the continued successful execution of ongoing critical missions.

1.1 GOALS AND OBJECTIVES

The goal of this proposed engineering study is to identify spectrum sharing methodologies which increase the ability to share spectrum between DOC/NOAA and other federal satellite broadcast receivers and commercial broadband operations while maintaining the capability of federal and nonfederal partners to access meteorological, space weather and other data necessary to complete their missions. This includes clarification as to the use of this band to aid in quantifying sharing challenges. In addition to the DOC sites that capture the downlink data in real-time and use the information for weather prediction, forecasting, water management and transportation, a multitude of other federal agencies and nonfederal organizations capture all or portions of the data in real time for use in providing other types of information to the public that may also have a significant impact on human life and/or property.; i.e., irrigation control across the western United States and developing flood watches and warnings. Real-time data captured for use in fighting wildfires across the entire U.S. is another important aspect of the use of this information. Additionally, state and local municipalities as well as commercial enterprises use the real-time data for early warnings for severe weather events such as tornadoes, etc. These civil and commercial entities rely on the information from the Emergency Management Weather Information Network (EMWIN) and the Low Rate Information Transmission (LRIT) to provide early warnings to protect their local citizenry; both services are in the 1680-1695 MHz adjacent band and will be examined in this study.

The primary objectives of the proposed engineering study are to perform analysis on numerous aspects of spectrum sharing in the 1675-1680 MHz frequency band and the adjacent 1680-1695 MHz frequency band between DOC and other federal Earth stations and wireless carriers and also examine alternative data delivery architectures for other federal and nonfederal entities that rely on NOAA data. Specifically, the study will establish a user/customer data flow and user needs baseline. This will aid in quantifying the potential impact to end users resulting from a loss of data availability and identifying methods to mitigate such impacts. Analysis will also be performed to determine Interference Protection Criteria (IPC) for federal Earth stations as well as the need for protection zones around those downlink sites. RFI monitoring and mitigation techniques will be examined for suitability for this issue. Alternative architectures will also be examined for implementation on future space and ground based assets, e.g., GOES-Next. Based on the outcome of sharing analyses, both spectrum and non-spectrum mitigation technologies will be examined to enhance and support successful spectrum sharing. Results from this study will be available to federal and nonfederal users/customers to help inform long-range planning efforts relating to both financial and information flow impacts.

1.2 Tasking Toward Meeting Goals and Objectives

There are 10 major tasks and multiple sub-tasks identified that will need to be completed to meet the objectives and goals of the proposed engineering study. In lieu of duplicating them in this section, please see a more detailed accounting of them in Section 2, Planned Activities and Anticipated Outcomes.

1.3 Duration

An estimation of the duration of the study of possible reallocation of the 1675 – 1680 MHz frequency band for sharing is presented in Section 5.3 below. A schedule estimate of each task and subtask defined in Section 2.2 below was created. Subtasks were analyzed for logical grouping for team execution, natural dependency upon another subtask's results for serial work and lack of dependency for parallel work. A coordination pre-study period has been included for most tasks, as has time for the formal publication and delivery of findings. Lastly, a short period for task closeout was added. These aspects contributed to the development of durations for each task.

As was done for the subtasks, the tasks themselves were also examined for dependencies requiring work in series; this was found to be true for Tasks 6 to 7, and Tasks 3, 4 and 5. The remaining tasks were identified for work in parallel. From here, a complete schedule for the overall study was developed, and it was found to be executable within 24 months from Authority to Proceed (ATP). This assumes that a viable contract vehicle is in place with the contractor(s) who will be executing the study. It should also be noted that while consideration to effort beyond the defined subtasks was given, such as pre-study coordination and task closeout, such efforts are necessary allotments to any contractual task and should not be misconstrued as "buffer". True schedule risk analysis was not performed, and this 24-month schedule estimate, while feasible, contains no built-in schedule margin.

1.4 Cost

An estimation of the cost to study the reallocation of the 1675 – 1680 MHz frequency band for sharing between the DOC/NOAA and nonfederal users and wireless carriers is presented in Section 7 below with an accompanying estimating methodology. This rough order of magnitude (ROM) cost estimate, $12.013 million, was generated based upon three primary inputs 1) the durations described in the preceding section, 2) the task and subtask definitions which constitute an initial scope of expected work, and 3) information describing the level of effort expended on previous studies of potential spectrum sharing. Analysis of costs and benefits as shown in Annex H (Page 72) shows a net benefit of $627 million based on assumptions that the costs will be similar for protecting the incumbent DOC Earth stations using the band as were estimated for the DOC AWS-3 transition plan. The estimated SRF relocation/sharing cost of $262 million does not include other federal Earth station users, so economic costs for the transition may be significantly higher if they are also factored into the Annex G spreadsheet and therefore the net benefit value may be further reduced.

1.5 Federal and Nonfederal Support

A critical aspect of meteorology is the ability to almost continually acquire sensor and other data for the creation of a meteorological forecast. DOC's National Weather Service (NWS) accepts and provides data from myriad sources, both federal and nonfederal (to include international partners). While there are a variety of different mediums for NWS and its meteorological partners to communicate weather information, the 1675-1695 MHz frequency band is perhaps the most critical for alerts, warnings, low-latency sensor data streams and meteorological data. The meteorological community views federal and nonfederal organizations as partners in weather forecasting and emergency management.

The NWS uses a multitude of the downlink data, from sensor data to the various imagery data. The Department of the Interior's Bureau of Reclamation (BOR) utilizes sensor data imbedded in the Low Rate Information Transmission data stream. This sensor data supplies information on river height and flow for numerous rivers in the western part of the U.S. used for managing the distribution of water across numerous states. Like the BOR, the National Interagency Fire Center (DOI) utilizes sensor data from approximately 2600 sensors across the western U.S. that provides information on temperature, humidity and wind velocity vital for battling wildfires. The Army Corp of Engineers also relies on sensor data for managing flood control in the central U.S.

The nonfederal aviation community relies heavily on accurate and timely weather data for safe and efficient aviation operations across all parts of the world, used by all airspace users, including commercial airlines, business aviation, helicopter operations and small General aviation aircraft. Universal Weather and Aviation (Houston TX) is one provider for weather data in the energy exploration sector, supporting helicopter operations and general aviation. American Airlines (Dallas TX) and Federal Express (Memphis TN) are two commercial carriers that currently operate GOES GVAR receiving systems in support of airline operations.

The Florida Department of Transportation (FDOT) directly transmits wind speed data from bridges along the Florida coast via GOES into state-owned and operated DCS receivers so that timely bridge closure decisions may be made in severe environmental conditions such as hurricane force winds. Bridges from islands and causeways remain open (for evacuation) if local officials feel that conditions are safe for evacuation. FDOT has primary and backup DCS direct reception receiving stations to acquire the wind speed on bridges in real time.

1.6 Current and Possible Future Architectures

NOAA radiosondes will continue operating in 1675-1680 MHz frequency band until the transition out of the band is completed.[1] Radiosondes provide high altitude atmospheric sensory data which is used by NOAA for weather forecasts. NOAA NWS takes radiosonde observations at 92 stations; 69 in the continental United States, 13 in Alaska, nine in the Pacific and one in Puerto Rico. NWS also supports the operation of 10 other stations in the Caribbean. Introduction of new commercial broadband systems into the 1675-1680 MHz frequency band before the completion of the radiosonde transition out of the band may cause harmful interference to NWS forecasts. Sharing of the 1675-1680 MHZ band with commercial users is expected to occur after the radiosondes transition is complete; however, areas of the country could become sharable as individual radiosonde sites complete their transition.

Current GOES-13, 14, 15 (operational present - 2020) satellites operate Sensor Data (SD) in 1675-1680 MHz frequency band. GOES-13, 14, 15 SD downlink contains the raw Imager and Sounder data collected by sensors onboard the spacecraft and transmitted to NOAA data acquisition stations. This downlink provides images required to track hurricanes and monitor the rapid development of severe storms that may develop into destructive tornados. This data stream is the basis for many of the satellite products that NOAA provides the public and private companies. Section 3.1 provides detailed GOES satellite information.

GOES-RSTU (operational 2017 to 2036) Data Collection Platform Reports (DCPR) system was relocated to 1679.7-1680.4 MHz frequency band, to accommodate AWS-3 sharing in 1695-1710

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[1] *See* Department of Commerce, National Oceanic and Atmospheric Administration, *Transition Plan for the 1695-1710 MHz Band, dated* October 29, 2015, *available at* https://www.ntia.doc.gov/files/ntia/publications/doc_noaa_web-ready_1jul14_final_rev7_admin_chng.pdf.

MHz frequency band. DCPR has over 400 channels within the spectrum from 1679.7-1680.4 MHz –relaying near-real time hemisphere data from approximately 27,000 data collection platforms. DCPRs are used as the primary source data for flood watch and warnings; they are a source of wildfire weather conditions necessary for wildfire fire managers to combat fires, and to protect the safety of firefighters, water managers use DCPR data to set water allocations, monitor water levels, and determine hazardous levels which threaten the integrity of dams and reservoirs. Coastal, stream, and river gauges, relayed via GOES / GOES-R DCS, are integral to maritime navigation safety on inland waterways and at US ports. DCPR carry some of the ocean buoy data and relay tsunami warnings to select coastal and island regions.

GOES-13, 14, 15 and the GOES-RSTU series operational life cycle is summarized in section 3.1 below. This "continuity of GOES mission" represents the use of the 1675-1680 MHz frequency band continuously until 2037 and beyond for GOES-NEXT. To maintain this continuity of service, the GOES Series of satellites have operational overlap between GOES-13, 14, 15 and GOES-RSTU and between GOES-RSTU and GOES-NEXT.

Future planned satellite systems (i.e. GOES-NEXT (Next Generation)) will require use of the 1676-1692 MHz frequency band to meet higher resolution requirements for GOES Rebroadcast (GRB) and DCPR operations.

There are additional users of satellite data broadcasts from GOES-R in the 1675-1680 MHz frequency band, which are geographically dispersed throughout the United States & Possessions (US&P).

The meteorological satellite band (1670 – 1710 MHz) is the internationally interoperable band for global weather and environmental sensing. The WMO database shows the use of the 1675 – 1680 MHz frequency band on a global basis. Examples of international collaboration include; (a) the ability of other countries in our hemisphere to receive future GOES data with mutually compatible receivers operating in the 1675-1680 MHz frequency band; (b) sharing of meteorological satellites between space agencies (i.e. NOAA satellites with EUMETSAT) on an emergency basis, or to fill a critical gap in coverage due to the loss of a satellite.

The DOC fully understands the responsibility of closely examining sharing of the 1675-1680 MHz band federal satellite broadcast receivers and performing a thorough examination of the sharing challenges as well as analyzing positive actions that can be taken in the form of RFI monitoring and/or mitigation techniques. Researching alternative delivery architectures for future generations of GOES to continue to provide valuable, actionable weather and sensor data to other federal and nonfederal users/customers and will also support successful spectrum sharing in this band with the Earth stations by possibly enabling larger geographic areas to be used for mobile broadband operations.

1.7 Closeout Statement

This engineering study will enable us to more clearly understand the full details associated with the hydrological, meteorological and space weather uses of the 1675-1695 MHz frequency band and provide us with a better understanding of the possible alternate delivery architectures for NOAA data which may better enable sharing this band. All tasks under this study, including those related to collecting information on non-federal users, must be completed to ensure that any sharing decision made will support efficient sharing with broadband operations while ensuring the continued execution of DOC missions. The outcomes from this study are expected to help inform a decision about whether to proceed to a spectrum auction not more than eight years from the time of funding. If sharing is found to be feasible, the estimated timeline for transitioning to shared use of the band will be based on the time required for implementation of the identified sharing methodologies and potential alternate delivery architectures.

There are many known federal data user receive stations and unknown state government, local government and commercial data user receive stations ingesting data from the downlinks that operate above 1675 MHz. A challenge for this study is clarifying data latency and reliability requirements of data users, including many unknown user stations, to develop NOAA data dissemination alternatives. While protection zones could be established around radiosonde receive sites, inflight radiosonde transmitters are expected to cause interference to commercial operations at distances of several hundred miles from each of the 92 radiosonde release points. Any potential sharing of the 1675-1680 MHZ band with commercial users is expected to occur after the radiosondes transition is complete; however, areas of the country could become sharable as individual radiosonde sites complete their transition.

2 Planned Activities and Anticipated Outcomes

2.1 Introduction

This Spectrum Pipeline Request addresses potential sharing of the 1675-1680 MHz frequency band (5 MHz of spectrum) among the DOC, other federal Earth stations, and wireless carriers nationwide. The engineering study will attempt to quantify the sharing challenges for federal Earth station users as well as identify techniques to facilitate successful spectrum sharing while ensuring the integrity of and access to the DOC NOAA data required for the national weather prediction capabilities and by state and local municipalities for early warning of impending severe weather.

2.2 Major Tasks

There are 11 tasks identified as being necessary to successfully complete the study and provide an accurate assessment of spectrum sharing in the 1675 – 1680 MHz frequency band. ROM cost data assumes all tasks are conducted as scheduled (see Table 2 below).

Table 1 - WBS Level 2 with ROM Cost Estimates

Task #	Subtask #	ROM Cost (BY$)	Description
1		$504,298	Identify spacecraft to end user data flows and user needs
	1.1	$69,558	Examining the in-band Data Collection Platforms (DCP) for GOES-RSTU
	1.2	$69,558	Examining the in-band Sensor Data (SD) for GOES-NOP
	1.3	$69,558	Examining the adjacent band GOES Rebroadcast (GRB) for GOES-RSTU
	1.4	$69,558	Examining the Multi-Use Data Link (MDL) for GOES-NOP
	1.5	$86,948	Examining other adjacent band federal services considered to be at risk of harmful interference from LTE operations in the 1675 – 1680 MHz frequency band
	1.6	$139,117	Examine the operational requirements for availability in conjunction with the satellite Program Office
2		$745,798	Analysis of potential interference to users
	2.1, 2.2	$154,951	2.1 Perform an analysis of federal user's receivers, filters, antennas and related environmental factors, i.e., impact of severe weather, atmospheric phenomenon, multipath, etc. 2.2 Perform an analysis of both in-band and adjacent band emissions

	2.3, 2.4, 2.5	$232,426	2.3 Identify those systems that are most likely to be at risk for interference from LTE sharing 2.4 Identify any specific LTE tower configurations that contribute to the identification of "at risk" systems/facilities 2.5 Identify federal sites/facilities that due to their geographic location and associated population density may be unlikely to experience RFI from LTE spectrum sharing
	2.6	$140,864	Examine the possibility of interactions between the LTE uplink service in the 1695 – 1710 MHz band and the LTE downlink service in the 1675 – 1680 MHz band and the possible effect, i.e., RFI, to the GOES downlinks in the 1675 – 1695 MHz frequency band
	2.7	$62,606	Identify the possibility of RFI and/or impacts to the MetSat downlink data captured by federal users in the U.S.
	2.8	$154,951	Identify all users with related mission functions that may be affected by spectrum sharing in the 1675 – 1680 MHz frequency band
3		$1,345,278	Identification of alternative architectures
	3.1, 3.2	$121,737	3.1 Identify possible alternative architectures for DCP data distribution 3.2 Identify possible alternative architectures for GRB data distribution
	3.3	$107,083	Characterize any possible methods for combining the SD and MDL downlinks into an alternative downlink format/structure
	3.4	$897,032	Provide comparative risk levels for a general class of users as it pertains to the current architectures; specifically addressing the timeliness of data capture, identification of any dependencies, additional change factors and other critical data flow factors
	3.5	$219,426	Identify the means for the design and implementation of each identified alternative architecture
4		$152,450	Developing the cost of alternative architectures
	4.1, 4.2, 4.3	$152,450	4.1 Develop a Rough of Order of Magnitude (ROM) cost estimate for the design, development and implementation of the DCP alternative architecture to include costs to both NOAA and other

			federal data users 4.2 Develop a Rough of Order of Magnitude (ROM) cost estimate for the design, development and implementation of the GRB alternative architecture to include costs to both NOAA and other federal and other data users 4.3 Develop a Rough of Order of Magnitude (ROM) cost estimate for the design, development and implementation of transitioning the SD and MDL to an alternative method of data capture to include costs to both NOAA and other data users
	4.4	$0	Develop and provide an estimated timeline for design and implementation of the above alternative architectures. *(No additional cost, task accomplished during estimation - no additional effort needed)*
5		$182,106	Alternative communication techniques for satellite downlinks
	5.1, 5.2, 5.3	$182,106	5.1 Evaluate and determine the potential latency and availability associated with any identified alternative architecture 5.2 Identify and evaluate options to meet the bandwidth requirements for GOES-Next, including higher orders of modulation techniques. Future generations of GOES will require additional bandwidth to accommodate higher resolution sensors, as well as the ability to accommodate a multitude of sensors on future spacecraft 5.3 Provide analysis as to whether current modulation schemes will meet future NESDIS requirements
6		$4,079,498	Detailed survey of receiving equipment
	6.1, 6.2	$4,079,498	6.1 Perform assessments of both federal and nonfederal ground stations and receiver sites for verification of characteristics. Perform interference susceptibility assessments of federal satellite broadcast receivers to aid in the development of adequate protection criteria. (Consider the amount of commercial signal that would fall within the RF passband of receiving systems and whether the power levels requested by commercial systems would create any non-linearity or compression of receive system amplifiers or electronics for in-band or adjacent band users.)

		6.2 Document the GOES data distribution architecture, its commercial applications and the potential impact on the national infrastructure due to loss of NOAA meteorological, space weather, and hydrological data dissemination.
7	$1,244,539	Protection studies
7.1	$724,095	Determine the requirements and methods for protecting both the legacy GOES and GOES-R downlinks, i.e., SD, MDL, GRB
7.2	$520,444	Determine the potential impact and susceptibility of federal satellite broadcast receivers to interference from in-band and/or adjacent band RFI from broadband wireless services using LTE or high-power transmitters operating either in-band or in an adjacent band, and develop protection criteria and protection zones for the federal users.
8	$317,079	Anomalous propagation interference to critical NOAA, DOD and DOI stations
8.1	$158,540	Develop protection requirements for NOAA ground stations/downlinks from the impact of interference as a result of anomalous propagation
8.2	$158,539	Provide analysis and the proposed requirements/recommendations to mitigate potential interference to federal satellite broadcast receivers from anomalous propagation
9	$855,559	Interference thresholds for federal GOES-R satellite broadcast receivers.
9.1	$120,433	Evaluate the benefits to spectrum sharing by having carrier identification information
9.2	$147,025	Validate and verify federal GOES-R satellite broadcast receiver thresholds through site testing at the WCDAS and at least one National Weather Service site, e.g., the Miami National Hurricane Center. A limited number of non-federal receivers may be included for comparison purposes with federal stations.
9.3	$588,101	Perform an analysis of the digital data processing at the NSOF and the WCDAS to develop accurate bit-error/frame error rate limits for use in determining harmful Interference

10	$985,303	Perform a radio frequency interference monitoring analysis for the 1675 – 1680 MHz frequency band
10.1	$197,061	Evaluate the possibility of employing carrier identification sharing to detect and mitigate LTE base station signals
10.2	$591,182	Perform an engineering analysis of RFI monitoring capabilities and technical specifications for NOAA ground stations (e.g., WCDAS and GOES-R) protection
10.3	$0	Conduct ground station surveys to determine system and configuration requirements. *(Assume done at time of subtask 6.1, so no additional cost.)*
10.4	$98,530	Evaluate existing and future monitoring system automation for minimizing impact to operations
10.5	$98,530	Analyze NOAA data management systems for any possible central or cloud-based monitoring configurations
11	$1,101,347	LTE TDD Simulations, Passive Site Surveys, and Active Test[2]
11.1	$89,435	Conduct research on TDD Standards Specification and parameters, characterize Baseline LTE FDD Downlink parameters, and calculate protection zone for federal ground stations.
11.2, 11.3	$669,587	Perform RF data collection to characterize RF environment at the selected facilities and to build a baseline of the current spectrum use for pre-LTE TDD activities in the 1675 – 1680 MHz and 1680-1695 MHz adjacent band. Characterize the antenna and system's responses to LTE UE and Base Station interference from 1675 – 1680 MHz in-band and 1680-1695 MHz out-of-band.
11.4	$95,554	Develop efficient sharing schemes and interference mitigation methods prior to the adoption of the technical rules. Validate, on a site-by-site basis, the effectiveness of proposed interference mitigation methods upon completion of real operation and prior to coordinated operation within the Protection Zones.

[2] Includes $61,781 in Pre-Study costs not reflected in subtasks.

11.5	$184,990	Provide assumptions, parameters, results of simulation, test results assessing the performance of each system, and recommendations.

2.3 Anticipated Outcomes

The overarching anticipated outcome for this study is to determine and identify sharing methodologies which support spectrum sharing in the 1675 – 1680 MHz frequency band with wireless carriers operating around federal earth stations and other satellite broadcast receiver sites.

- The Task #1 outcome will provide a documented baseline of the operational characteristics of the DOC sites for both in-band (1675 – 1680 MHz) and adjacent band (below 1675 MHz and the 1680 – 1710 MHz fequency band) first and foremost, and then determine if this same baseline applies to other federal sites as well. Provide a determination as to the probability of harmful interference and determine the operational availability requirements and apply them to the baseline.
- The Task #2 outcome will provide an analysis of the respective sites and capabilities to include antennas, receivers, filtering capability and associated environmental factors that may be pertinent to successful spectrum sharing with wireless carriers. Additionally, it will provide a list of users of NOAA satellite data within the US&P that share these characteristics of interest.
- The Task #3 outcome will provide alternative architectures/methods of data distribution that addresses both legacy GOES and GOES-R operations. As part of the proposed alternative architectures, risk levels will be established for the differing classes of users and will provide information on the impacts to the reliability, timeliness and other potential changes to the critical data flow to end users.
- The Task #4 outcome will provide a ROM cost for each recommended potential architecture, along with a schedule for design, development and implementation of the respective architectures.
- The Task #5 outcome will provide information regarding the latency and availability of data r eceipt based upon the recommended alternative architectures. Additionally, recommendations for GOES-Next requirements for larger bandwidths and improved modulation techniques will be provided with various options.
- The Task #6 outcome will provide a detailed survey of the equipment of a cross section of sites. The survey results will provide information detailing federal Earth station and satellite broadcast receiver susceptibility to interference. Posible mitigation approaches will be assembled and assessed.
- The Task #7 outcome will quantify the impact to federal Earth station sites and other satellite receivers from in-band and adjacent band interference from LTE or

other high power transmitters near said sites or locations. Definitive protection criteria and protection zones will be identified and documented.

- The Task #8 outcome will provide the results of analysis of anomalous propagation along with the recommended requirements and actions to mitigate future events.
- The Task #9 outcome will provide the bit error and frame error rate thresholds above which there will be degraded or lost data. Additionally, recommendations as to the use of carrier identification will be beneficial in the FI monitoring process.
- The Task #10 outcome will provide information regarding the state of current and future monitoring capabilities. Unlike the AWS-3 monitoring, the 1675 – 1680 MHz frequency band will be a downlink from the base stations to the User Equipment (UEs). The potential use/availability of carrier IDs will be addressed, and information regarding discussions with representative AWS carriers (primarily those AWS carriers interested in the band) as to the use of carrier IDs by DOC for use in monitoring will be documented and included as part of the outcome.
- The Task #11 outcome will provide a detailed survey of the equipment of a cross section of federal earth ground sites. As a result of the survey, information detailing federal earth station susceptibility to interference and potential mitigation approaches will be collected and assessed. Quantify the impact to federal Earth station sites from in-band and adjacent band interference from TDD LTE operations or high power base station transmitters in the vicinity of said sites.

3 DOC Satellite Systems Usage and Associated User Receiver Systems

3.1 GOES Satellite System Description

DOC'S GOES are used for short-term weather forecasting and severe storm tracking. These are the satellites that continuously watch over the Western Hemisphere providing images of severe weather events such as Hurricane Irene and Tropical Storm Lee that are seen by millions of Americans every day in their local or national media outlets. GOES collects numerous atmospheric and surface parameters such as ice, snow and vegetation; atmospheric temperatures; moisture, aerosol and ozone distribution using instruments sensing in visible, near-IR, and thermal IR frequencies. Space and solar instruments on the GOES monitor the highly variable solar and near-Earth space environment. The satellites also detect Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPRBs) and Personal Locator Beacons (PLBs) as part of the international COSPAS-SARSAT system.

GOES-R is flying six new instruments, including the first operational lightning mapper in geostationary orbit. This new technology will enable scientists to observe lightning, an important indicator of where and when a storm is likely to intensify. Forecasters will use the mapper to hone in on storms that represent the biggest threat. Improved space weather sensors on GOES-R will monitor the sun and relay crucial information to forecasters so they can issue space weather alerts and warnings. Data from GOES-R will result in 34 new, or improved, meteorological, solar and space weather products.

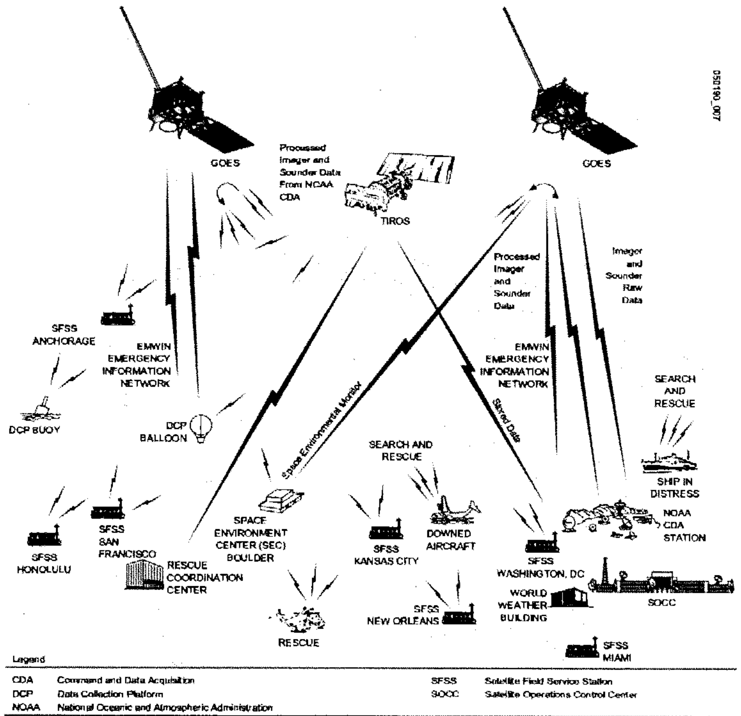

Figure 1 - 21st Century Weather Watch System (Boeing, 2005)

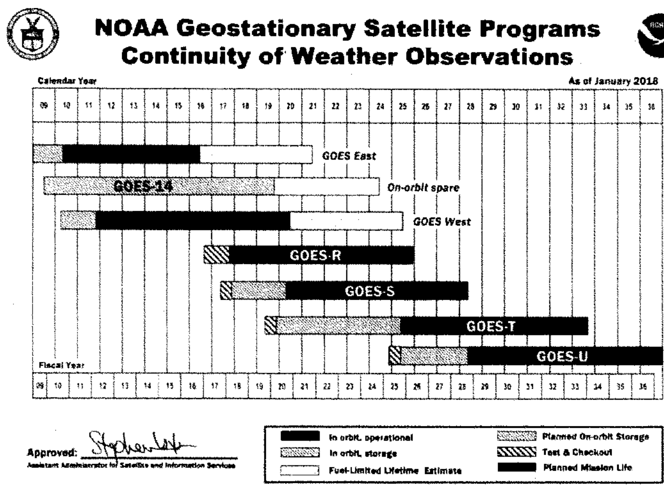

Figure 2 - GOES Fly-out Schedule[3]

3.2 User Receiver Systems

Federal and nonfederal GOES broadcast receivers currently use the 1675-1695 frequency MHz band for receiving direct broadcasts from meteorological satellites. For example, meteorological satellite direct broadcast to the Aviation Weather Center (AWC) in Kansas City is used to provide the aviation sector with access to the full range of GOES-R data OCONUS. Meteorological satellite direct broadcast is critical for hurricane and ocean weather models provided to marine and land transportation and alerts to the U.S. coastal population. There are approximately 200-300 GVAR/GRB stations, 10,000 EMWIN receivers, and 100 DCP receivers located in the US&P. In addition, as with the aviation sector, there are numerous downstream users of data from these broadcasts who are not the direct operators of weather satellite receive stations.

About 15 industry sectors are dependent upon federal and private sector meteorology products that use meteorological satellite direct broadcasts as a partial or full source of data. Thousands of EMWIN users have automated sirens, issue warnings and call in staff from direct broadcast for tornados, storm surge, tsunami, etc.

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[3] Note that until the GOES-RSTU are in orbit, determining a fuel-limited lifetime estimate is not realistic and not provided. Once launched a fuel-limited lifetime estimate will be included in addition to the satellite's mission life.

4 NEW PROPOSED SYSTEMS, TECHNOLOGIES, AND APPLICATIONS

To meet the future need of the GOES data end users, an examination of the existing and known future architectures will be undertaken to establish a baseline of both federal and nonfederal users along with the type of data they utilize primarily in completing their respective missions.

4.1 ALTERNATIVE ARCHITECTURES FOR NOAA GOES DATA DISTRIBUTION

Devising new architectures for existing systems with both ground and space based assets is complex and requires a significant amount of lead time to accomplish successfully.

The existing network of NOAA users is configured to capture the legacy GOES downlink data and have begun capturing the GOES-R downlink data. GOES-R launched in November of 2016 with an end of life expectancy of at least 2026. GOES-S is under construction and expected to launch in 2017 with an end life expectancy of 2028.

Any new alternative architectures to be employed to enhance spectrum sharing will need to be developed and approved within the next few years to ensure sufficient lead time to meet the requirements for the GOES-T & U spacecraft, or to plan on changes to the meet the development of new architectures for GOES-Next.

The proposed study will focus on new systems and technologies in support of the GOES-Next generation of satellites and ground systems. Advances in modulation techniques and data compression algorithms provide the opportunity to possibly move GOES-Next downlinks to a higher frequency band to support higher data rates and more detailed imagery data. Methods of mitigating losses due to atmospheric influences in the higher frequency bands would have to be investigated. Any alternative architecture developed because of this study will be compared to the existing architecture to identify all dependencies that may have an impact on a successful design, development and implementation.

4.2 ALTERNATIVE DISTRIBUTION OF GOES DATA

Distribution of the GOES data via the internet or other terrestrial networks will be examined as one of the alternative architectures.

4.3 RADIO FREQUENCY INTERFERENCE MONITORING SYSTEM

As part of the DOC AWS-3 transition activity, a Radio Frequency Interference Monitoring System (RFIMS) is to be installed at 17 Department of Commerce (DOC)/National Oceanic Atmospheric Administration (NOAA) and National Weather Service (NWS) locations to enhance sharing of the 1695 – 1710 MHz frequency band with wireless carriers. The objective of the RFIMS is to protect the 1695 – 1710 MHz downlinks at these locations. This proposed study will evaluate the use of this RFMIS or a modified version of it to support sharing of the 1675 – 1680 MHz frequency band.

5 SPECTRUM UNDER STUDY FOR SHARING AND TIMELINE FOR COMMERCIAL USE

The geographic area that is intended for sharing of the 1675-1680 MHz frequency band is the United States and Possessions (US&P). This area would be subject to limitations based on the conclusion of this engineering study which may identify federal Earth station "protection" or "exclusion" zones within the US&P. The coverage of the GOES downlink reaches beyond the US&P. However, analysis for sharing with terrestrial AWS beyond the US&P will not be considered in this study.

5.1 ADJACENT BAND (1680 – 1695 MHZ) CONSIDERATION

DOC is relocating radiosondes operations from the 1675-1680 MHz band to the 400 MHz band to prevent interference to GOES-R operations which were shifted down in frequency to enable sharing of the 1695-1710 MHz frequency band (AWS-3).

The adjacent band (1680-1695 MHz) is expected to be vulnerable to the stronger terrestrial based transmissions associated with LTE downlinks. Additionally, with the 1695-1710 MHz band being used in accordance with AWS-3 as an uplink transmission for LTE, the effects of receiving a weak satellite downlink in between these two opposing relatively strong terrestrial signals will need to be fully understood and characterized as part of this investigation.

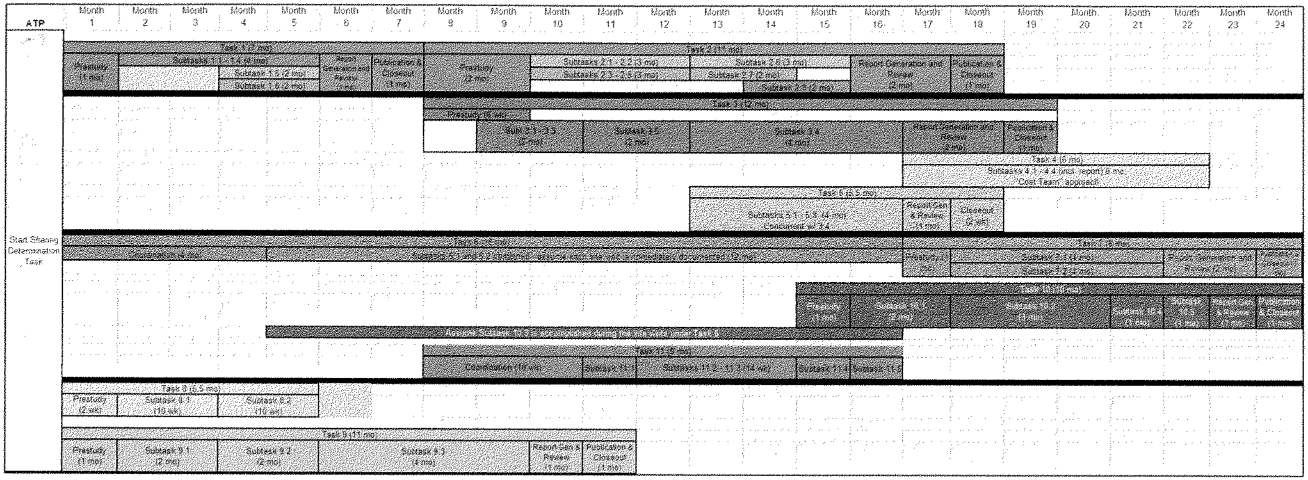
5.2 PRIMARY REGULATORY PROTECTION OF CURRENT AND FUTURE NOAA SATELLITE SYSTEMS

Harmful interference will not be caused to services operating in accordance with the Table of Frequency Allocations. See 47 CFR §2.102 – Assignment of Frequencies. Additional information regarding current and planned NOAA satellite spectrum assignments can be found in Annex D below.

5.3 STUDY TIMELINE

Table 2 - Tentative Task Timeline, below, identifies the planned execution of the tasks, some of them concurrent with each other, which demonstrates conducting the task within the 24-month period from the initiation of funding:

Table 2 - Tentative Task Timeline



Does not include margins or risks and assumes start date from funding/contract point.

Upon completion of the study, proposed methodologies for federal satellite broadcast receivers sharing with LTE TDD or LTE downlink operations will be identified. The needed steps for sharing implementation then need to be resolved.

Completion of the 24-month long task will provide information needed to allow a decision for proceeding with 1675-1680 MHz frequency band repurposing to be made with greater clarity as to requirements, processes and cost. Radiosonde operations in the band may impact the band transition time line. Timelines for any determined sharing architectures to be implemented as part of the transition to sharing of the band will be estimated during this study.

6 MEASURABLE GOALS AND OBJECTIVES, TECHNOLOGY READINESS LEVELS (TRL)

6.1 SYSTEMS UNDER EVALUATION

The current systems under evaluation for this study are both the legacy GOES[4] and GOES-R systems that have operations in the 1675 – 1695 MHz frequency band. This band is used as a space to earth link, and thus the issue involves multiple receive sites, both federal and nonfederal across the United States.

A partial list of federal and nonfederal users of GOES data can be found in Annex B below. The list of both federal and nonfederal users/customers of the GOES data is extensive, with each entity on the list having a need for the data. A complete list of all users of GOES data does not currently exist as the broadcast nature of the data enables anyone with the appropriate receiver equipment, which does not require registration, to access the data.

6.2 PARAMETERS TO MEASURE (INTERFERENCE PROTECTION CRITERIA AND INTERFERENCE MITIGATION TECHNIQUES)

To accurately develop effective Interference Protection Criteria (IPC) and Interference Protection and/or Mitigation Techniques for federal satellite broadcast receivers, it will be necessary to perform both active and passive site surveys at various NOAA/NWS sites, DOI sites, and DOD sites as well as a few select other federal agency sites to establish susceptibility parameters and potential mitigation approaches.

Passive testing will be comprised of capturing data from GOES receiver output to measure the SNR, E_b/N_0, noise floor, bit error and/or frame error rates that are representative for the differing types of receivers, demodulators, etc. across the respective user/customer base.

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[4] Legacy GOES refers to the series GOES-13, 14 and 15 or GOES-N, O and P.

Active testing will involve transmitting a LTE-like downlink signal into a non-operational GOES antenna while it is also receiving a GOES downlink to more accurately determine the IPC and the parameters identified above.

The Commerce Spectrum Management Advisory Committee (CSMAC) Working Group -1 Report provides information on the approach and methodology the working group utilized to determine adequate Interference Protection Criteria for the 17 government facilities that would be affected by the sharing of the 1695 – 1710 MHz frequency band. The DOC/NOAA will examine this AWS uplink approach for applicability to the sharing of the 1675 – 1680 MHz frequency band with wireless carriers using it as an AWS downlink.

6.3 Anticipated Technology Readiness Levels (TRL) for Any Systems that May Be Affected

The following are definitions of the NASA Technology Readiness Levels (TRLs) as utilized by DOC for determining the readiness of both ground and space based systems for operational use.

Technology Readiness Levels Summary

- TRL 1 Basic principles observed and reported
- TRL 2 Technology concept and/or application formulated
- TRL 3 Analytical and experimental critical function and/or characteristic proof-of concept
- TRL 4 Component and/or breadboard validation in laboratory environment
- TRL 5 Component and/or breadboard validation in relevant environment
- TRL 6 System/subsystem model or prototype demonstration in a relevant environment (ground or space)
- TRL 7 System prototype demonstration in a space environment
- TRL 8 Actual system completed and "flight qualified" through test and demonstration (ground or space)
- TRL 9 Actual system "flight proven" through successful mission operations

The current state of DOC/NOAA legacy GOES space-based and ground-based assets is TRL 9. All have been successfully proven and have been in use for years.

The GOES-R communications system is at TRL 8.

The GOES-NEXT satellite (beyond GOES-U) has not been formally funded for development at this time and therefore a TRL is not yet available.

7 BUDGET AND PROJECT MANAGEMENT

In section 2.2 above, the budget estimate is presented by task and the methodology is explained below along with a cost breakout by function. Note that this is a ROM cost estimate according to *GAO-09-3SP: GAO Cost Estimating and Assessment Guide* (GAO, 2009). Alternate study timeline scenarios have not been estimated, and cost and schedule risks have not been assessed. Neither cost nor schedule margin has been included in the estimate.

7.1 ESTIMATING WORK BREAKDOWN AND STRUCTURE

A work breakdown structure (WBS) was created to ensure a more complete cost to the government was calculated.

Table 3 - Estimating WBS

1.0	Prestudy
2.0	Program Management
2.1	Management
2.2	Task Lead
3.0	Review
4.0	Engineering
5.0	Procurements
6.0	Report Generation, Publication, and Closeout
7.0	Other Direct Costs (ODCs)
7.1	Travel/Misc.
7.2	G&A
7.3	Fee
8.0	Other Government Costs (OGCs)
8.1	Program Management Office (PMO)
8.2	OGCs
8.3	Management Reserves (MR)
8.4	NOAA Overhead (OH)

Element 1.0 Pre-study is designed to capture the effort associated with establishing new tasking on an existing contract; therefore, no source selection costs are included in the estimate. Pre-study cost and duration are built into all task estimates, except for Tasks 4 and 5 which are expected to coincide with Task 3. The inclusion and estimation of this WBS element were informed by analysis of actuals; see the subsequent subsection for explanation.

Element 2.0 Program Management is comprised of two sub-elements. The Management sub-element includes task oversight performed by the contractor, and is estimated by a wrap factor generated from analogous program actuals. The task lead sub-element contains the part-time task leadership dedicated to each task, again excepting Tasks 4 and 5 which are expected to piggy-back on Task 3.

Element 3.0 Review captures management and peer support to reviews prior to the publication of findings and recommendations, and is estimated by a wrap factor generated from analogous program actuals; see the subsequent subsection for explanation.

Element 4.0 Engineering is the core staff dedicated to working the subtasks.

Element 5.0 Procurements impacts only Tasks 9 and 10, and covers the identification and purchase of suitable test articles.

Element 6.0 Report Generation, Publication and Closeout are self-explanatory.

Element 7.0 Other Direct Costs (ODCs) contains three typical sub-elements. Travel/Misc., General and Administrative (G&A), and fee are calculated using industry-standard wrap factors.

Elements 1.0 through 7.0 in sum represent the contractor costs. Element 8.0 includes four additional categories of government costs. The Program Management Office (PMO) is assumed to be staffed by four government employees, whose time will be dedicated to this study is scaled according to the amount of effort expended by the contractor in each month. Also, included in the PMO costs is additional government support. Other government costs (OGCs) covers government travel, supplies and other miscellaneous government costs, and is estimated by standard factor. Management reserves (MR) and NOAA overhead (OH) are estimated by wrap factor (10% and 5%, respectively). This was informed by other NOAA program history.

7.2 Basis of Estimate: Labor Costs

The estimate to perform the spectrum sharing study is based upon staffing and schedule assumptions made by task and subtask per their descriptions. Spectrum sharing has been studied before, and there are similarities between several of the tasks proposed here and previous studies. Actual staff sizes, the skill mix, hours, expenditures and durations for these analogous studies were gathered and analyzed; this analysis informed the assumed contractor staff sizes and durations, which in turn formed the basis of estimate. Government program office labor is accounted for, but it is sized by assumption rather than analogy.

With a staffing profile in place, the cost of labor was calculated using assumed labor rates. These rates were taken from published contractor and GS pay scales. Published in ranges, the rates used were varied according to skill level. Overhead was added directly to the labor rates according to estimating rule-of-thumb. G&A and contractor fee were separately accounted for in the ODC element of the WBS using industry-standard factors. Once the labor portions of the estimate were calculated, remaining cost elements were added using either additional staffing assumptions or wrap factor.

7.3 Staffing Profile

The staffing profile for the assumed 24-month total study duration is shown in Figure 3 below. It depicts the sum of all FTEs by month for all tasks and subtasks, phased according to the proposed study timeline in Table 2 on page. Note that the effort associated with WBS 6.0 Report Generation, Publication and Closeout is included as "Engineering" labor in the figure, as it is assumed a subset of the engineering staff in WBS 4.0 will remain onboard through findings publication and task completion.

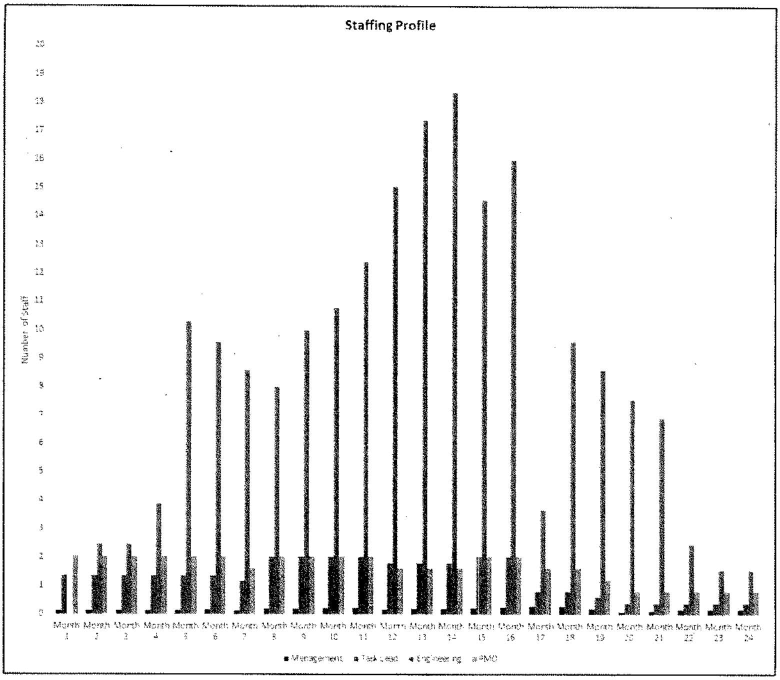

Figure 3 - Staffing Profile

7.4 CLOSE OUT COSTS

The total costs for the study, given the assumed staffing profile (above) and the proposed study timeline in Table 2 in section 5.3 above, are shown by year. Subsequently, costs are shown over time by task and by WBS element.

Table 4 - Total Costs (BY$) by WBS Element by Year

WBS Element	Description	Total	Year 1	Year 2
	Total Cost	$ 12,013,256	$ 6,214,178	$ 5,799,078
1.0	Pre-study	$ 200,674	$ 167,861	$ 32,813
2.0	Program Mgmnt.	$ 1,658,584	$ 921,156	$ 737,428
3.0	Review	$ 253,246	$ 111,602	$ 141,644
4.0	Engineering	$ 4,144,047	$ 1,991,128	$ 2,152,919
5.0	Procurements	$ 350,000	$ 100,000	$ 250,000
6.0	Report Generation, Publication, Closeout	$ 297,043	$ 61,536	$ 235,507
7.0	Other Direct Costs	$ 2,347,636	$ 1,312,339	$ 1,035,297
8.0	Other Gov. Costs	$ 2,762,026	$ 1,548,556	$ 1,213,470

7.5 Budget Summary

As expected, the Engineering WBS category is the primary contributor of cost. Pre-study and Procurements costs are in family with the analogous programs. Program management, Reviews and ODCs' percent contributions to total cost are in line with typical program metrics. OGCs at 24% are slightly higher than typical program metrics, but not high enough to be of concern. Report Generation, Publication and Closeout's contribution to total cost is far lower than typical, but this is explainable: Tasks 4, 6, 8 and 11 contain report publication explicitly stated as a subtask, so that effort is booked under 4.0 along with all other subtasks.

8 Statutory Requirements

There are numerous authorities for requesting funds from the Spectrum Reallocation Fund (SRF) identified in the MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES; M-16-13, June 2, 2016. (Shaun Donovan, 2016). There are Primary Mission Essential Functions (PMEFs) identified that support the DOC/NOAA in the development of this Spectrum Pipeline engineering study funding request.[5] Annex H contains PMEF text and additional related information.

8.1 Authorities Identified in the OMB Guidance document

8.1.1 The Spectrum Reallocation Fund was established in 2004 by the "Commercial Spectrum Enhancement Act" (CSEA). (Congress, Commercial Spectrum Enhancement Act (CSEA), 2004). The purpose was to establish a process for Federal entities to recover costs associated with relocating their spectrum-dependent systems from bands that either were auctioned or going to be auctioned for commercial use.

[5] The National Continuity Policy Implementation Plan, Homeland Security Council, August 2007, was issued to build on The National Continuity Policy, (NSPD-51/HSPD-20). (House, 2007) These plans identify the National Essential Functions and the associated Primary Mission Essential Functions of the various Agencies.

8.1.2 The follow-on to the CSEA was the "Middle Class Tax Relief and Job Creation Act of 2013 (P.L. 112-96, or the Tax Relief Act). (Congress, Middle Class Tax Relief and Job Creation Act of 2012, P.L. 112-96, 2012). This Act amended the CSEA and provided for eligible agencies to receive funds for spectrum sharing in addition to relocation purposes. Additionally, the law also expanded the types of costs that could be funded or reimbursed.

8.1.3 The Spectrum Pipeline Act of 2015 (Title X of P.L. 114-76) amended the CSEA to include provisions for federal agencies to request funding from the SRF for research and development and/or planning purposes (Congress, Spectrum Pipeline Act of 2015, 2015), provided such funding is expected to facilitate a future spectrum auction and meet other requirements.

8.2 Potential Implications for Failure to Fully Analyze Possible Band Sharing and Reallocation Implications

Potential interference to NOAA satellite downlink transmissions that result from the reallocation or sharing of the band would likely result in an increased risk for loss of life and property. The health, safety and welfare of the United States would be adversely affected by the loss of timely, reliable and accurate hydro meteorological forecasts, watches and warnings of severe weather.

Aviation and other transportation-dependent activities would be severely impacted should appropriate mitigation and protection steps not be taken. Loss of the numerical forecast database would degrade the ability to provide forecasts of atmospheric dispersion in hazardous materials incidents. This degradation would negatively impact situational assessment, the determination of evacuation areas and routing and resource allocation and positioning. The lack of advance knowledge of large-scale natural events (e.g., hurricanes) could result in recovery operations being consumed by the event. In HAZMAT or events involving weapons of mass destruction, the lack of observations, forecasts, and numerical modeling would degrade operations in DHS Interagency Modeling and Atmospheric Assessment Center, DOD's Defense Threat Reduction Agency, and other federal, state and local and tribal first responders. It is imperative that a comprehensive engineering study be undertaken to ensure that actions taken towards sharing with federal satellite broadcast receivers are known, deliberate and have results that are expected and appropriate for ensuring the continued missions supported by this band and the adjacent band.

8.3 Potential of 1675-1680 MHz Frequency Band Sharing Resulting from This Study

The many challenges to sharing of the 1675-1680 MHz frequency band are more complex than those for sharing of the 1695 – 1710 MHz band due to federal and nonfederal use of the data downlinked in the band and the interdependency between the DOC and its other federal and nonfederal partners in the weather enterprise. Establishing appropriate protection zones around all mission essential federal Earth station receive sites, mitigation protection for other federal satellite broadcast receivers and developing equivalently reliable and timely alternative meteorological, space weather, and hydrological data delivery means for all users would ensure protection of the federal sites, and make band sharing with federal stations more economically viable. This comprehensive engineering study will identify spectrum sharing methodologies that increase the ability to share spectrum between

DOC/NOAA satellite systems and commercial broadband operations while maintaining the capability of federal and nonfederal users to access NOAA data necessary to complete their missions.

9 OTHER FEDERAL DATA USERS

9.1 FEDERAL ENTITIES AND ASSOCIATED BUREAUS AND OFFICES

These federal data users may have interest in the implementation of the results of the engineering study, mitigation techniques or alternate architecture identified, and may require a change in their system configuration or operations. NOAA is singularly responsible for the transmission of the data and will advise all organizations and entities on the findings from the engineering study.

- Department of Interior – Bureau of Land Management
- Department of Interior – U.S. Geological Survey
- Department of Interior – Bureau of Reclamation
- Department of Interior – National Park Service
- Department of Interior – Bureau of Indian Affairs
- Department of Interior – U.S. Fish and Wildlife Service
- International Boundary and Water Commission
- Department of Commerce – National Weather Service
- Department of Commerce – National Ocean Service
- Department of Defense – U.S. Army Corps of Engineers
- Department of Defense – U.S. Air Force
- Department of Defense – U.S. Navy
- Department of Defense – U.S. Marine Corp.
- U.S. Environmental Protection Agency
- Tennessee Valley Authority
- U.S. Department of Agriculture – Agricultural Research Service
- U.S. Department of Agriculture – Forest Service

9.2 PLANNED PROJECT MANAGEMENT STRUCTURE

Given the schedule and budget as reported herein, the management structure proposed includes the following:

- "Management", defined as oversight performed by the contractor
- One part-time task lead per task (one person can support multiple tasks)
- A government program management office (PMO), comprised of four part-time government employees whose time contribution is correlated to the overall amount of contractor effort

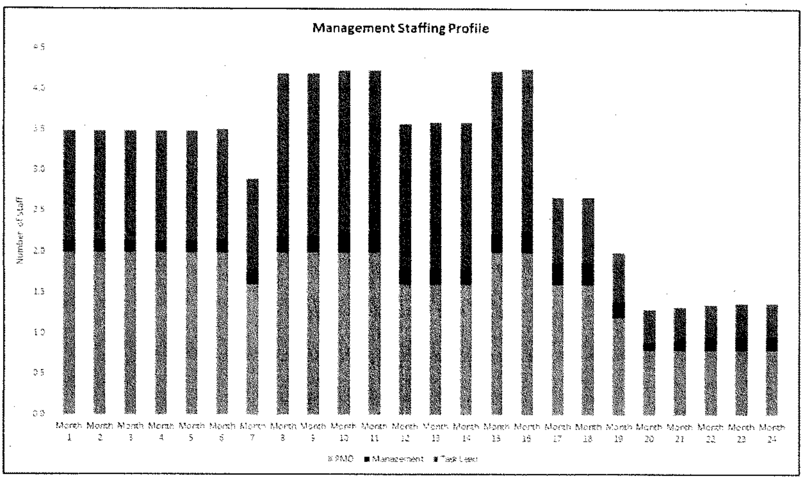

Figure 4 - Planned Management Structure

9.3 PLANNED ALLOCATION OF FUNDING AMONG AGENCIES AND BUREAUS.

DOC/NOAA is the lead Government Agency performing and managing this proposed study. NOAA will coordinate inputs, from the associated Federal entities, for incorporation into this study.

10 CONTACT INFORMATION

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10.5 GOVERNANCE STRUCTURE

The governance structure for this investigation of sharing potential in the 1675-1680 MHz frequency band with considerations for the adjacent 1680-1695 MHz frequency band shall be contained within the DOC/NOAA. Consideration for alternative architectures and mitigation techniques will be established and provided to all dependent organizations and agencies upon completion of this study and approval of the recommended approach. Descriptions of the tasks can be found in section 2.2 on pages 7 through 12. The division of tasking for each task lead is based on the task schedule and resource requirements.

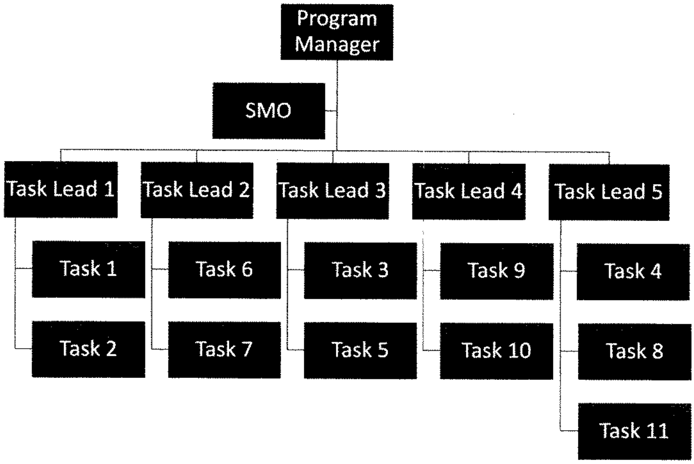

Figure 5 - Project Management Organizational Structure

11 Conclusion

This study is expected to identify spectrum sharing techniques, alternate architectures, and other sharing methodologies which may increase the ability to share spectrum between DOC/NOAA GOES satellite Earth stations, satellite broadcast receivers, and commercial broadband operations while maintaining the capability of federal and nonfederal users to access meteorological, space weather and other related data necessary to complete their missions. With the importance of the information conveyed within the 1675 – 1680 MHz frequency band and the adjacent 1680 – 1695 MHz frequency band, the sharing study will examine all the myriad uses that comprise the functionality of this band to ensure the continued successful execution of ongoing critical DOC and other federal missions.

12 Annex A – Acronyms and Citations

12.1 Acronyms List

http://www.goes-r.gov/resources/acronyms.html

12.2 Citations

Alion Science & Technology. (2013). *Potential Interference to GOES-R Downlinks in the 1675-1710 MHz Band from Proposed LTE Mobile Systems in the 1695-1710 MHz Band.*

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13 Annex B – Partial List of Federal and Nonfederal Users of GOES Data

AccuWeather

Aerojet Corporation Azusa, California, USA CA

Aerospace Corporation, El Segundo, California, USA CA

Alaska Aviation Weather Unit, NOAA/NWS, Anchorage AK

American Airlines, Dallas TX

American Airlines Flight Academy DFW Airport, Texas, USA TX

Applied Physics Laboratory Seattle Washington, USA WA

Arizona Department of Water Resources

Association of Metropolitan Water Agencies

Atmospheric & Environmental Research, Inc. Cambridge, Massachusetts, USA MA

Aviation Weather Center, Kansas City MO

Baron Services, Huntsville AL

Battelle, Pacific Northwest Laboratories Richland, Washington, USA WA

Boeing Aerospace Seal Beach, California, USA CA

Brookhaven National Laboratory Upton, New York, USA NY

California Department of Water Resources, Sacramento CA

Central Pacific Hurricane Center, Honolulu HI

Chelan County Washington Public Utility District

City College of New York New York, NY, USA NY

City of Fort Collins CO, Stormwater Utility

City of Seattle, Seattle City Light

Colorado Department of Natural Resources

Colorado State University

Colorado State University Ft. Collins, Colorado, USA CO

Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin-Madison, Madison WI

Department of Transportation/FAA, Atlantic City NJ

Earth Networks

Elizabeth City State University (ECSU) Elizabeth City, North Carolina, USA NC

Environmental Medicine Center Natick, Massachusetts, USA MA

Environmental Technologies Group, Inc. Baltimore, Maryland, USA MD

EWW Weatherwise – Enterprise AL

Fairweather Environmental Services Anchorage, Alaska, USA AK

Federal Express Corporation Memphis, Tennessee, USA TN

Florida Department of Transportation

Florida Division of Emergency Management Tallahassee, Florida, USA FL

Georgia Institute of Technology, Hydrologic Research Center Atlanta, Georgia, USA GA

GINA- Geographic Institute of Alaska Fairbanks

Global Imaging

Hampton Roads Planning District, Hampton Roads, VA

Harris

Hawaii Aviation Weather Unit

Hawaiian Airlines

Honolulu Community College, Honolulu HI

Idaho Department of Water Resources

Inter-National Research Institute San Diego, California, USA CA

Interstate Council on Water Policy, Rockville MD

Jet Propulsion Laboratory Pasadena, California, USA CA

Jet Propulsion Laboratory, Ames Research Center Wrightwood, California, USA CA

Johns-Hopkins University, Applied Physics Laboratory Laurel, Maryland, USA MD

Joint Typhoon Warning Center (USN and USAF) Pearl Harbor, Hawaii, USA HI

Joint Water Commission (Hillsboro, Forest Grove, Beaverton and Tualatin Valley OR)

Kansas Natural Resources Subcabinet

KLM Airlines

Lockheed Martin

Louisiana Delta Community College, Monroe LA

Louisiana State University

Louisiana State University, Earth Scan Lab Baton Rouge, Louisiana, USA LA

Lower Colorado River Authority

Marta Systems

Mesa Arizona Water Resources

Miami Conservancy District

Michigan Technical University Houghton, Michigan, USA MI

Minnesota Department of Natural Resources

Monsanto

Montana Department of Natural Resources and Conservation

MORCOM International

NASA Ames Space Flight Center

NASA Spaceflight Meteorology Center

NASA/Ames Research Center Sunnyvale, California, USA CA

NASA/Goddard Space Flight Center Greenbelt, Maryland, USA MD

NASA/Langley Research Center Hampton, Virginia, USA VA

NASA/SPoRT/Short-term Prediction Research and Transition Center, Huntsville AL

National Center for Atmospheric Research

National Center for Atmospheric Research (NCAR) Boulder, Colorado, USA CO

National Hurricane Center, Miami FL

National Interagency Fire Center

National Naval Ice Center Washington, D.C., USA DC

National Ocean Service

National Oceanic and Atmospheric Administration (NOAA) Coast Watch Caribbean Node, AOML, Miami FL USA

National Oceanic and Atmospheric Administration (NOAA) Inouye Regional Center, Ford Island Honolulu, HI

National Oceanic and Atmospheric Administration (NOAA), Forecast Systems Laboratory Boulder, Colorado, USA CO

National Oceanic and Atmospheric Administration (NOAA), Wallops Command and Data Acquisition Station, Wallops VA

National Operational Hydrological Research Service, Minneapolis MN

National Snow and Ice Center

Naval Research Lab, Stennis Space Center Bay Saint Louis, MS USA MS

NESDIS - University of Wisconsin Madison

New York State Department of Environmental Conservation, Division of Water

New York State Department of Transportation

New York State Flood Plain and Stormwater Managers Association, Albany NY

NOAA National Ocean Service, Chesapeake, VA

NOAA Satellite Operations Command and Control (NSOF) Suitland, Maryland, USA MD

NOAA Western Region, Seattle WA

Northrop Grumman Bellevue, NE, USA NE

Northrop Grumman Electronics Systems Azusa, CA, USA CA

Northwest Arkansas Beaver Water District

Orbital Systems / Quorum Communications Dallas

Oregon State University, College of Oceanic & Atmospheric Sciences Corvallis, Oregon, USA OR

Portland Water Bureau, Portland OR

Purdue University Lafayette, IN, USA IN

Radian International Dayton, Ohio, USA OH

Red River Basin Commission – Minnesota – North Dakota – South Dakota – Moorhead MN

Rutgers University New Brunswick, NJ, USA NJ

Salt River Project Phoenix, Arizona, USA AZ

San Francisco Public Utilities Commission

San Francisco State University, Romberg Tiburon Center San Francisco, California, USA CA

Science Applications International Corp. Bellevue, Washington, USA WA

Science Applications International Corp. Monterey, California, USA CA

Scripps Institute of Oceanography, Center for Coastal Studies La Jolla, California, USA CA

Scripps Institute of Oceanography, Arctic and Antarctic Research Center La Jolla, California, USA CA

Scripps Institute of Oceanography, Center for Clouds, Chemistry and Center for Clouds, Chemistry and Climate La Jolla, California, USA CA

SEASPACE Corporation Poway, CA USA CA

South Florida Water Management District

Southern Nevada Water Authority

Spaceflight Meteorology Center, Johnson Space Flight Center, Houston TX

State of Delaware Public Service Commission

State University of New York –Brookhaven Brookhaven, New York, USA NY

State University of New York –Buffalo, Buffalo, New York, USA NY

Storm Prediction Center, Norman OK

StormGEO/Impact Weather (US offices New York, Miami, Houston, San Francisco area, Anchorage)

Susquehanna River Basin Commission, Harrisburg PA

Tampa Bay Water, Tampa FL

Texas Natural Resource Conservation Commission Austin, Texas, USA TX

U.S. Air Force-Phillips Laboratory Hanscom AFB, Massachusetts, USA MA

U.S. Army Research Institute of Environmental Medicine Center Natick, Massachusetts, USA MA

U.S. Army Research Laboratory, White Sands Missile Range New Mexico, US NM

U.S. Coast Guard Academy, Groton CT

U.S. Forest Service Ogden, Utah, USA UT

U.S. Marine Corp. / NCCOSC San Diego, California, USA CA

U.S. National Biological Service Anchorage, Alaska, USA AK

U.S. Naval Oceanographic Office Stennis Space Center, MS

U.S. Naval Research Laboratory (NRL) Monterey, California, USA CA

U.S. Naval Research Laboratory (NRL) Stennis Space Center, MS, USA MS

Unisys Weather, Malvern PA

United Airlines

United States Department of Agriculture, US Forest Service Salt Lake City, UT, USA UT

United States Naval Oceanographic Office (Fleet Numerical Oceanographic Center) Pearl Harbor, Hawaii, USA HI

United States Naval Oceanographic Office Norfolk, Virginia, USA VA

United States Naval Oceanographic Office San Diego, California, USA CA

Universal Aviation & Weather, Houston TX

University Corporation for Atmospheric Research (UCAR) Boulder, Colorado, USA CO

University of Alaska, Geophysical Institute Fairbanks, Alaska, USA AK

University of California, Davis

University of California, Santa Barbara, Institute Computational Earth Systems Science Santa Barbara, California, US CA

University of Delaware Newark, DE, USA DE

University of Hawaii, Satellite Oceanography Laboratory Honolulu, Hawaii, USA HI

University of Maine Orono, Maine, USA ME

University of Massachusetts –Dartmouth, Dartmouth, Massachusetts, USA MA

University of Miami, Miami, Florida, USA FL

University of Nebraska Lincoln, Nebraska, USA NE

Upper Arkansas River Conservancy Project, Salida CO

US Forest Service, Remote Sensing Applications Center, Salt Lake City UT

US International Boundary and Water Commission, El Paso, TX

Weather news Norman OK

Western States Water Council, Murray Utah

Woods Hole Oceanographic Institution, Boston MA

WSI, A Division of the Weather Channel

14 Annex C – GOES Data Usage

14.1 DCS (DCPR, DCPI) – GOES-NOP and GOES-RSTU

The GOES DCS is a system for collecting and transmitting environmental data from remote platforms via government-owned and -operated geostationary satellites. Users are composed of many Federal, State, and local agencies required to monitor environmental and Earth resources for a variety of purposes. These purposes include; meteorological analysis and forecasting, river forecast, tsunami warnings, flood warnings, reservoir management, dam monitoring, water quality monitoring, fire potential, navigation, irrigation control, seismic monitoring, and other highly variable phenomena where observations must be collected frequently and in real-time. The GOES DCS provides near real-time access to data, and is used by state, local, and emergency managers in the United States and in nearby nations to provide early warning of natural and manmade disasters that threaten life and property. Monitoring sites to warn of floods, fires, tsunamis, hurricanes, tornadoes, and dam breaches are only a few of the applications of the system. The GOES DCS is considered critical infrastructure for NOAA (NWS and National Ocean Service), USGS, DOD, the NIFC, the Bureau of Land Management, the National Forest Service, and international hydro-meteorological agencies in Canada, Mexico, Central America, South America, the Pacific, the Caribbean, and all around the western hemisphere.

The GOES DCS system represents user requirements defined by the deployment of more than 30,000 DCPs from Africa westward to eastern Australia. Over 500 organizations, government agencies, and representatives of government agencies operate the GOES DCS. The primary users of the GOES DCS are:

- Department of Interior – Bureau of Land Management
- Department of Interior – U.S. Geological Survey
- Department of Interior – Bureau of Reclamation
- Department of Interior – National Park Service
- Department of Interior – Bureau of Indian Affairs
- Department of Interior – U.S. Fish and Wildlife Service
- International Boundary and Water Commission
- Department of Commerce – National Weather Service
- Department of Commerce – National Ocean Service
- Department of Defense – U.S. Army Corps of Engineers
- Department of Defense – U.S. Air Force
- Department of Defense – U.S. Navy
- U.S. Environmental Protection Agency
- Tennessee Valley Authority
- U.S. Department of Agriculture – Agricultural Research Service
- U.S. Department of Agriculture – Forest Service

The GOES DCS is vital to the operation of several Federal agencies to reduce loss of life and minimize property damage. The USGS uses the GOES DCS to transmit stream gauge information for flood warning and obtain seismic observations to warn the aviation industry of volcanic eruptions. These observations are critical for air traffic safety. In addition, USGS obtains data on earthquake location (size and strength). The Pacific Tsunami Warning Center uses this data to provide tsunami information to countries and islands of the Pacific basin and the Caribbean.

NOAA operates a ground system at the WCDAS in Virginia, and is in the process of completing the installation of a backup site in Suitland, Maryland. Data from these sites are distributed to users in various ways, including rebroadcast to a satellite and distribution through the Internet. Many users who access DCS data for emergency warnings and emergency management also receive data directly from the NOAA satellites, due to the critical nature of their responsibilities.

The Data Collection Platform Report (DCPR) transponder is a bent-pipe, i.e., receiving signals from the DCPs in 401.7-402.4 MHz frequency band, then translating these data to a new frequency band, amplifying, and transmitting in the space-to-Earth direction using the 1694.5 and 1694.8 MHz frequencies, but with no other processing. (NTIA, Department of Commerce, 2010)

14.2 GOES Rebroadcast (GRB) – GOES-RSTU

The GRB will provide the primary relay of full resolution, calibrated, near-real-time direct broadcast space relay of Level 1b data from each instrument and Level 2 data from the Geostationary Lightning Mapper (GLM). GRB will replace the GOES VARiable (GVAR) service. The GRB contains the ABI, GLM, space environment, and solar data which drive data flow in the NOAA space and Earth environment research and operational framework.

GRB will use two digital streams, each at 15.5 Mbps, compared to the GVAR standard of a single 2.11 Mbps stream. A dual polarization approach will be used to accommodate the 31 Mbps data rate within a frequency bandwidth of 9.8 or 10.9 MHz per polarization, using a standard downlink modulation at 1686.6 MHz (L-band). GRB will be able to produce a full disk image in either five or fifteen minutes, depending on mode, compared to GVAR's thirty minutes.

The GRB processed instrument data source will be packetized compliant with Consultative Committee for Space Data Systems (CCSDS) standard 133.0-B-l and will utilize lossless data compression to fit within allocated bandwidth. Data blocking and accompanying header metadata will be used to minimize risk of loss due to link errors and allow for user verification of data integrity. (NOAA GOES-R Program Office)

14.3 Low Rate Information Transmission (LRIT) – GOES-NOP

LRIT is a global signal supported by European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), Japan Meteorological Agency, and NOAA. The U.S. LRIT service provides visible and infrared sectors as well as full disk imagery to support users from 70ºN-70ºS from 15º W to 170º E. The service also includes selected meteorological and oceanographic charts, in-situ observations, and emergency warning information. The NOAA LRIT system provides digital data, via a broadcast service, through its geostationary satellites. NOAA operates an LRIT broadcast on its

GOES-East and GOES-West satellites. On the GOES-R series of satellites, the broadcast is expected to merge with the EMWIN service (see section 13.4).

The LRIT broadcast's primary use is to support forecasting and warning in the Caribbean, Central and South America and, in the Pacific Basin, to the principal population centers and outer islands of the Small Island Developing States (SIDS) member countries. Included in the LRIT service are the GOES DCS observations and the NWS's EMWIN broadcasts. In addition to the Pacific Tsunami Warning Center, SIDS member countries can receive the same tsunami warnings from the DCS and EMWIN systems via the LRIT. In Central and South America, including the Caribbean region, LRIT is the primary source of satellite data necessary for heavy precipitation monitoring, flood warnings, and general forecasting. (NTIA, Department of Commerce, 2010)

14.4 Emergency Managers Weather Information Network (EMWIN) – GOES-NOP & GOES-RSTU

The EMWIN is designed to provide vital data to the emergency management community. NOAA's NWS provides a broadcast of live weather and civil emergency information to computers across the United States, the Caribbean, South America, and over most of the Pacific and Atlantic Oceans. EMWIN has been made available by the NWS in cooperation with NESDIS since 1995. Since then, the emergency management community has had immediate access to information pertaining to threats from powerful weather events and the threat of serious civil disasters. Emergency information using the center frequency of 1692.7 MHz is broadcast via the GOES East and West satellites extending the coverage to the eastern edge of Australia. This allows the EMWIN signal to cover roughly two thirds of the Earth's surface and it is used both nationally and internationally. In addition, the use of both satellites allows signal redundancy for most of the continental United States.

The 1675-1710 MHz frequency band make it a well-suited delivery system for mobile use due to the characteristics that it provides such as minimal rain-fade, small dish size, and availability of affordable receiver components. The EMWIN delivers weather warnings in all weather conditions. An inverter and automobile battery are all that are necessary to power the EMWIN system for hours to receive the GOES satellite data stream.

The EMWIN system's primary use is warning the public and to send warning products and other processed data (graphics and imagery) that are needed by emergency managers. Its flexibility and low cost allows it to be used by even small emergency management units anywhere in the United States. The warning and weather information is transmitted in digital form and is customized to meet the needs of emergency managers. The data can be received, demodulated, and displayed on a computer by emergency managers, homeland defense, and the public. The system is typically used to trigger sirens, pager networks, cell phones and other means of communications used by emergency managers. Many users of these systems are mobile in nature (i.e., Red Cross Emergency Response Trucks) and can easily make use of the EMWIN signal. The receiver dishes do not require stowing during high winds, allowing the system to be used during severe weather events, including hurricanes. In addition to very fast priority driven weather warning products, EMWIN also provides rapid dissemination of forecasts, graphics, and imagery to aid in increasing lead times for emergency managers. EMWIN not only provides this data but does so in a manner that can continue to work during and following disaster conditions when non-satellite forms of communication are unavailable. Furthermore, the inherent redundancy of the GOES satellite constellation means that EMWIN can continue to operate after the failure of one of the satellites. These attributes allow decision-making to be more accurate and responsive for warning and possibly evacuating communities, saving lives and property.

The NWS gathers live weather and emergency information from NWS forecast offices via the Telecommunications Gateway, which is a message switching center linked via redundant fiber optic channels to other major network nodes that provide the EMWIN system and other sources across the globe with weather watches, warnings, and forecasts. The EMWIN system then broadcasts selected and prioritized data. Satellite downlink enables users to access the EMWIN data stream of real-time weather information anywhere within the "footprint" of the GOES satellites. Today, the service is transmitted from the GOES satellites using 1692.7 MHz. Because of the auction of 1695-1710 MHz frequency band, NOAA will relocate the GOES-R era EMWIN downlink transmission planned for 1697.4 MHz to a frequency below 1695 MHz. (NTIA, Department of Commerce, 2010)

14.5 Satellite Telemetry – GOES-NOP & GOES-RSTU

The GOES telemetry and command subsystem provides the functional interface between the spacecraft and ground command and control. It is composed of both radio frequency and digital (baseband) segments. Telemetry parameters describing the status, configuration, and health of the spacecraft payload and subsystems are downlinked to the Command and Data Acquisition (CDA) station and sent to the Satellite Operations Control Center. Commands are received onboard the spacecraft for controlling mission operations and managing expendable resources. (NTIA, Department of Commerce, 2010)

14.6 Multi-Use Data Link (MDL) – GOES-NOP

The MDL data is received at the Spacecraft Operations Control Center as an independent data link. This data is processed by the Spacecraft Support Ground System and used for diagnosing dynamic interactions among the instruments and the spacecraft. The MDL is also received by the SWPC in Boulder, Colorado, for ingest of Solar X-ray Imager (SXI) and Space Environment Monitor (SEM) data. (NTIA, Department of Commerce, 2010)

14.7 Processed Data Relay (PDR) – GOES-NOP

The GOES PDR data transmission format, referred to as GVAR (GOES Variable Data Format) is primarily used to transmit Imager and Sounder meteorological data. It also includes telemetry, calibration data, text messages, spacecraft navigation data, and auxiliary products. The PDR format originated in the operational visible infrared spin scan radiometer, atmospheric sounder (VAS) mode AAA of the earlier spin-stabilized GOES spacecraft. The AAA format consisted of a repeating sequence of 12 fixed-length, equal size blocks whose transmission was synchronized with spacecraft spin rate (that is, one complete 12-block sequence for each rotation). The range and flexibility of satellite operations are increased by the deployment of the three-axis stabilized GOES N-P spacecraft which employ two independent instruments, each with a scanning mirror having two degrees of freedom. The use of a fixed-length transmission format would have constrained the operational capabilities of the N-P spacecraft. (Boeing, 2005)

14.8 Sensor Data (SD) – GOES-NOP

The Sensor Data downlink in the 1673.4-1678.6 MHz frequency band contains the raw Imager and Sounder data collected by sensors onboard the GOES spacecraft. Without these data, there would be no images to track hurricanes or monitor the rapid development of severe storms that may develop into destructive tornados. This data stream is the basis of many of the satellite products produced continuously and available for public use and by private companies. (NTIA, Department of Commerce, 2010)

14.9 Aviation: Commercial and Private Business

Aircraft that fly beyond CONUS require detailed forecasts and warnings- OCONUS GOES-R data will be degraded via NWS's broadcast network which cannot carry all the full resolution OCONUS GOES-R data. Primary source for many Federal and private sector products is meteorological satellite direct broadcast.

The Alaska office is responsible for all aviation flight level and area forecasts across a broad area of the most active volcanic region in the world. Alaska is a satellite centric forecast region having few surface observation stations. Vast areas are only sensed by satellites. Without meteorological satellite direct broadcast, the reduced data available via NOAA satellite broadcast network (SBN) would be inadequate for volcanic ash prediction and the cryospheric program. (Rivera, 2015)

14.10 Electric Generation and Utilities

The problem for this commercial sector begins with the electric power grid. "Electric power is modern society's cornerstone technology on which virtually all other infrastructures and services depend." Yet it is particularly vulnerable to bad space weather. Ground currents induced during geomagnetic storms can melt the copper windings of transformers at the heart of many power distribution systems. Sprawling power lines act like antennas, picking up the currents and spreading the problem over a wide area. The most famous geomagnetic power outage happened during a space storm in March 1989 when six million people in Quebec lost power for 9 hours.

Today, power grids may be more vulnerable than ever. The problem is interconnectedness. In recent years, utilities have joined grids together to allow long-distance transmission of low-cost power to areas of sudden demand. On a hot summer day in California, for instance, people in Los Angeles might be running their air conditioners on power routed from Oregon. It makes economic sense—but not necessarily geomagnetic sense. Interconnectedness makes the system susceptible to wide-ranging "cascade failures."

To estimate the scale of such a failure, report co-author John Kappenmann of the Metatech Corporation looked at the great geomagnetic storm of May 1921, which produced ground currents as much as ten times stronger than the 1989 Quebec storm, and modeled its effect on the modern power grid. He found more than 350 transformers at risk of permanent damage and 130 million people without power. The loss of electricity would ripple across the social infrastructure with "water distribution affected within several hours; perishable foods and medications lost in 12-24 hours; loss of heating/air conditioning, sewage disposal, phone service, fuel re-supply and so on."

"The concept of interdependency," the report notes, "is evident in the unavailability of water due to long-term outage of electric power--and the inability to restart an electric generator without water on site."

The strongest geomagnetic storm on record is the Carrington Event of August-September 1859, named after British astronomer Richard Carrington who witnessed the instigating solar flare with his unaided eye while he was projecting an image of the sun on a white screen. Geomagnetic activity triggered by the explosion electrified telegraph lines, shocking technicians and setting their telegraph papers on fire; Northern Lights spread as far south as Cuba and Hawaii; auroras over the Rocky Mountains were so bright, the glow woke campers who began preparing breakfast because they thought it was morning. Best estimates rank the Carrington Event as 50% or more strong than the superstorm of May 1921.

"A contemporary repetition of the Carrington Event would cause ... extensive social and economic disruptions." Power outages would be accompanied by radio blackouts and satellite malfunctions; telecommunications, GPS navigation, banking and finance, and transportation would all be affected. Some problems would correct themselves with the fading of the storm: radio and GPS transmissions could come back online quickly. Other problems would be lasting: a burnt-out multi-ton transformer, for instance, can take weeks or months to repair. The total economic impact in the first year alone could reach $2 trillion, some 20 times greater than the costs of a Hurricane Katrina. (Phillips, 2009)

14.11 Transportation: Land, Rail and Maritime

On October 8, 2005, AccuWeather issued a flash flood warning to their American Rail Dispatching Center Client specifically for the railroad track from Palmer, MA to Windsor, VT. This commercial sector product warned rail crews to watch for high water and track washouts. An identified and immediate closure of a 30' deep by 30' long washed out section of rail track saved an Amtrak passenger train from hitting the washout area at 59 MPH, which would have resulted in a catastrophic derailment. (Rivera, 2015)

Real-time tide and current data is used to promote navigation safety for maritime navigation. PORTS® information when combined with up-to-date nautical charts and precise positioning information can provide the mariner with a clearer picture of the potential dangers that may threaten navigation safety. PORTS® has the potential to save the maritime insurance industry from multi-million dollar claims resulting from shipping accidents.

14.12 Agriculture

Growers and producers of crops fundamentally rely on accurate, timely and reliable weather information. Weather affects almost every aspect of agricultural business from determining the timing of harvest, to efficiently ventilating greenhouses. Extreme weather causes lower yields, crop destruction or an increase in production costs. Also the supply chain and production facilities are dependent on reliable weather forecasts.

14.13 Other Commercial Sectors

"There exists in the United States a unique national weather enterprise. This consists of a community of meteorologists and other professionals in academic, private, and government sectors who provide services to, and are supported by, a growing community of users, also part of the enterprise. The meteorological community develops and distributes weather products and services to the user community in order to protect life, reduce risk to property, and enhance economic competitiveness. ... private-sector meteorologists work for media outlets, equipment manufacturers, companies that manage weather risk, consulting services and elsewhere."

[illegible]	[illegible]	[illegible]
Aviation	Safety of Life & Flight Reliability of performance	Air service disruption (re-route & delay)
Energy Generation & Utilities	Assured power availability	Protection of power infrastructure
Energy Exploration & Mining	Safety of personnel	Continuity of production
Communication & Satellite	Telecomm reliability	Degraded or loss of service
Agriculture	Safety of Life & Livestock Protection of property	Loss of production GPS degradation to agribusiness
Public: OCONUS States & Possessions	Safety of life & property	Public forecasts, regional aviation, marine, flooding & tsunami
Coastal Home-owners	Safety of life – storm surge	Pre-evacuation preparation

Figure 6 - Potential for Commercial Economic Impact

These private sector companies develop meteorological products tailored to a specific industry, often using NOAA's science data as a basis, to generate their own or to tailor it for segment specific end users.

Sectors	Socio	Economic
Public: Emergency Management	Safety of life & protection of property	
Transportation: Land, Rail & Maritime	Safety of life and property	Disruption of shipping services to dependents
Health Care	Protection of life & evacuation decisions	Efficient and effective facility actions in crisis
Defense	Protection of man power and equipment Effective weather operations	
Manufacturing	Protecting employees & sheltering facilities	Production of profits
Tourism, Sports & Recreation	Safety of life	Mitigate loss of revenue
Hydrology	Flood warning & evacuation	Loss of property
Media	Mass communication of warnings	

[9]

Figure 7 - Potential for Commercial Economic Impact

15 Annex E – Spectrum Assignments - Current and Planned

15.1 NOAA Quantitative Assessment (QA)

Full details on the NOAA QA are available in the report provided to NOAA/NESDIS (Alion Science and Technology, 2014).

Table 5 - NOAA Quantitative Assessment Table (abridged)

Rx State/Country	Rx Antenna Location	Frequency(ies)
AK	Elmendorf AFB	M1685.7,
AK	Fairbanks	M1676, M1678, M1680, M1681.478, M1682, M1685.7, M1691, M1694, M1694.5, M1694.8
AK	Gilmore Creek	M1676, M1681.478, M1685.7, M1691, M1694, M1694.5, M1694.8
CO	Boulder	M1681.478
CO	Table Mountain	M1694
HI	Hickam AFB	M1685.7
ID	Boise	M1694.8
MD	Greenbelt	M1676, M1681.478, M1685.7, M1691, M1694, M1694.5, M1694.8
MD	Suitland	M1676, M1681.478, M1685.7, M1686.6, M1691, M1693, M1694, M1694.5, M1694.8
NE	Offutt AFB	M1685.7,
PR	Guaynabo	M1694.8
SD	Sioux Falls	M1694.8
TN	Knoxville	M1694.8
VA	Wallops Island	M1676, M1679.9, M1680.2, M1681.478, M1685.7, M1686.6, M1688.1, M1688.2, M1688.3, M1688.4,

		M1688.5, M1688.6, M1688.7, M1688.8, M1688.9, M1689, M1689.1, M1689.2, M1689.3, M1689.4, M1689.5, M1689.6, M1689.7, M1689.8, M1689.9, M1691, M1692.7, M1693, M1694, M1694.1, M1694.45, M1694.5, M1694.8
WV	Fairmont	M1676, M1679.9, M1680.2, M1681.478, M1685.7, M1686.6, M1691, M1693, M1694, M1694.1, M1694.5, M1694.8
USP	USP	M1679.9, M1680.2, M1685.7, M1686.6, M1691, M1692.7, M1694.1
Radiosondes	USP (multiple locations)	M1676, M1678, M1680, M1682

Note that the above abridged QA only pertains to NOAA assignments and does not include the large number of receivers owned by other federal and nonfederal users dedicated to receiving the GOES downlink data broadcasts.

Receivers are not required to be registered for use and as such are very difficult to quantify. NOAA and others have attempted to identify, through voluntary disclosure requests, the large number and types of receivers being used to receive NOAA satellite transmissions. There have not been sufficient numbers of users responding to make any conclusions meaningful.

15.2 GOES-R NTIA Stage- 4 Certification

GOES-R frequency assignments are in line with the NTIA signed Stage-4 certification per the attached IRAC Doc. 41947/1, dated 20 April 2016.

FORM NTIA-44 (3/91) U.S. DEPARTMENT OF COMMERCE NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION CERTIFICATION OF SPECTRUM SUPPORT	Classification UNCLASSIFIED	Control Number Doc. 41947/1 SPS-21678/1 ERP-1551
Recipient Agency: Commerce	System: GOES-R Series Geostationary Meteorological Satellites	Stage of Review: 4 – Operational

Section 1: OPERATING CHARACTERISTICS FOR WHICH SUPPORT IS CERTIFIED

Frequency (MHz)	Emission	Mean Power (W)	Station Class	Function	Transmit Locations	Receive Locations
401.7 401.85 402 402.4	0H00N0N	0.5	TM TW	Data Collection Platform Report Pilot Data	Fairmont, WV	Space (60° W, 75° W, 89° 30' W,105° W, 137° W)
		0.3			Wallops Island, VA	
401.7-402.4	300HG1D 1K20G1D	40	TM TW	Data Collection Platform Report Data	US&P Fairmont, WV	
		13			US&P Wallops Island, VA	
406-406.1 (Receive)	1K60G1D	---	TE	Emergency Position Indicating Radio Beacon Search & Rescue Data	US&P	
468.775 468.825	44K5G1D	3.2	EM EW	Data Collection Platform Commands Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	US&P
1544.55	100KG7D	3.3	EI	Search & Rescue Data		US&P Suitland, MD
1679.9 1680.2	400KG7D	7.9	EM	Data Collection Platform Report Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	Fairmont, WV Wallops Island, VA Suitland, MD US&P
1686.6	9M79G1D 10M9G1D	56	EM	Rebroadcast Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	Fairmont, WV Wallops Island, VA Suitland, MD US&P
1693	8K00G1D	1.58	EM	Command and Data Acquisition Telemetry Data		Fairmont, WV Wallops Island, VA Suitland, MD
	80K0G1D	3.5				
1694.1	1M21G1D	17	EM	Emergency Managers Weather Information Network Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	Fairmont, WV Wallops Island, VA US&P
2027.1		76	TM	Emergency Managers Weather Information Network Data	Fairmont, WV Wallops Island, VA	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W
2032.775 2032.825	44K5G1D	2	TM TW	Data Collection Platform Commands Data	Fairmont, WV Wallops Island, VA	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W
2034.2	8K00G1D 128KG1D	310	TT	Command Data		
2036	1M50G3N	155	TT	Ranging Data		
	71K4G2D 84K0G2D			Command Data		

Downgrading Instruction	Classification	Page Number
	UNCLASSIFIED	1 of 3

Figure 8 - GOES-R Stage 4 page 1

Form NTIA-44 (3/91) CONTINUATION PAGE	Classification UNCLASSIFIED	System GOES-R Series Geostationary Meteorological Satellites

Frequency (MHz)	Emission	Mean Power (W)	Station Class (Stage 4)	Function	Transmit Locations	Receive Locations
2211.04	1M50G3N 4M92G2D 4M93G2D	1.3	ET	TT&C and Ranging Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	Fairmont, WV Wallops Island, VA
7216.6	9M79G1D 10M9G1D	150	TM	Rebroadcast Data	Fairmont, WV Wallops Island, VA	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W
8220	120MG1D	11	EW	Raw Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	Fairmont, WV Wallops Island, VA

Section 2: SOURCE DOCUMENTS

Docket Number	Description of Document	Dated
SPS-21094/2	Commerce Request for Stage 4 System Review	February 1, 2016
SPS-21558/2	NTIA Preliminary Assessment	April 6, 2016

Section 3: SPECTRUM PLANNING SUBCOMMITTEE (SPS) RECOMMENDATIONS

The SPS reviewed this system under the provisions of Chapter 10 of the NTIA Manual, and recommends that:

1. NTIA certify Stage 4 spectrum support for the GOES-R Series Geostationary Meteorological Satellites, as specified in Section 1.
2. Commerce:
   a. be aware that operations using the downlink frequencies 468.75 MHz and 468.85 MHz must be conducted on secondary basis to non-federal stations operating in the fixed and land mobile services as specified in Footnote US289 to the National Table of Frequency Allocations;
   b. coordinate with non-federal terrestrial receiving stations at fixed sites for the Fairmont and Wallops Island earth station transmitters using the frequencies 2027.1 MHz, 2032.775 MHz, 2032.825 MHz, 2034.2 MHz, and 2036 MHz, in accordance with Footnote US346 to the National Table of Frequency Allocations;
   c. take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference in the band 1670-1690 MHz in accordance with Footnote US211 to the National Table of Frequency Allocations; and
3. Commerce coordinate with the World Meteorological Organization for operations of this system that use of frequencies in the band 401.7-402.4 MHz, and at the frequencies 401.7 MHz, 401.83 MHz, 402 MHz, 402.4 MHz, 408.775 MHz, 468.825 MHz, 1679.9 MHz, 1680.2 MHz, 1686.6 MHz, 1693 MHz, 1694.1 MHz, 7216.6 MHz, and 8220 MHz.
4. Commerce coordinate with the COSPAS/SARSAT program for operations using frequencies regarding emergency position indicating radio beacons in the bands 406-406.1 MHz and 1544-1545 MHz.
5. Commerce submit coordination contours to the SPS for the Fairmont, WV earth station to transmit in the band 2025-2110 MHz and receive in the bands 1675-1710 MHz and 2200-2290 MHz; for the Wallops Island, VA earth station to transmit at the frequency 2036 MHz; and for both the Wallops Island, VA and Fairmont, WV earth stations to transmit in the band 7190-7235 MHz and receive in the band 7900-8500 MHz, in accordance with Section 8.3.13 of the NTIA Manual.
6. Commerce protect personnel from radiation levels that exceed generally accepted exposure criteria.

Distribution	Classification	Page Number
IRAC, SPS, FAS, EPS	UNCLASSIFIED	2 of 3

Figure 9 - GOES-R Stage 4 page 2

Form NTIA-44 (8/81) CONTINUATION PAGE	Classification UNCLASSIFIED	System **GOES-R Series Geostationary Meteorological Satellites**

Section 3: SPS RECOMMENDATIONS

Name/Title of Recommending Official	Signature	Date
Binyam Tadesse SPS Vice Chairman		APR 2 0 2016

Section 4: NTIA CERTIFICATION

The band 1675-1695 MHz is part of the NTIA quantitative assessment (QA) of the agencies' actual use of the spectrum called for in the 2013 Presidential Memorandum entitled "Expanding America's Leadership in Wireless Innovation." The NTIA QA plan is contained in Appendix A of the Fourth Interim Progress Report on the Ten-Year Plan and Timetable available at http://go.usa.gov/PT6H. Each agency with current operations in the bands under consideration in the QA, along with any agency expecting to deploy, change, or cease operations of systems in the band are required to report to NTIA on their projected usage, termination, and future developments. Furthermore, this office advises Commerce that the President's budget proposals for the past few years have proposed repurposing for auction the 1675-1680 MHz band and introduction of new terrestrial mobile broadband systems in the band may have an impact on the supportability and compatibility of the subject system. The most recent proposal contained in the FCC's FY 2017 budget (available at p. 6 of https://apps.fcc.gov/edocs_public/attachmatch/DOC-337668A1.pdf), recognizes that any repurposing of this band would be "subject to sharing arrangements with Federal weather satellites" and that limited protection zones for the remaining weather satellite downlinks and alternative data broadcast systems would be developed if the proposal is enacted. The FCC also has pending a petition for rulemaking (RM-11681) proposing to initiate a rulemaking proceeding to allocate the 1675-1680 MHz band for non-federal terrestrial mobile use on a shared basis with federal users. The Office of Spectrum Management concurs with the SPS recommendations in Section 3.
This office certifies Stage 4 spectrum support for this system.

Name/Title of Certifying Official	Signature	Date
Peter A. Tenhula Deputy Associate Administrator		APR 2 0 2016
Distribution	Classification	Page Number
IRAC, SPS, FAS, EPS	UNCLASSIFIED	3 of 3

Figure 10 - GOES-R Stage 4 page 3

15.3 GOES-NEXT NTIA Stage-1 Certification

GOES-NEXT frequency assignments have been established for future missions. These GOES-NEXT frequency assignments will be in line with the NTIA signed Stage-1 certification per the attached IRAC Doc. 41948/1, dated 20 April 2016.

FORM NTIA-44 (3/91) U.S. DEPARTMENT OF COMMERCE NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION CERTIFICATION OF SPECTRUM SUPPORT	Classification: UNCLASSIFIED	Control Number: Doc. 41948/1 SPS-21679/1
Recipient Agency: Commerce	System: Geostationary Operational Environmental Satellites (GOES)-Next Series	Stage of Review: 1 – Conceptual

Section 1: OPERATING CHARACTERISTICS FOR WHICH SUPPORT IS CERTIFIED

Frequency (MHz)	Emission	Mean Power (W)	Station Class (Stage 4)	Function	Transmit Locations	Receive Locations
401.7 401.85 402 402.4	0H00N0N	0.5	TM TW	Data Collection Platform Report Pilot Data	Fairmont, WV / Wallops Island, VA	Space (60° W, 75° W, 89° 30' W, 105° W, 137° W)
401.7-402.4	300HG1D 1K20G1D	40 / 13	TM TW	Data Collection Platform Report Data	US&P Fairmont, WV / US&P Wallops Island, VA	
406-406.1 (Receive)	1K60G1D	—	TE	Emergency Position Indicating Radio Beacon Search & Rescue Data	US&P	
468.75 [illegible]	44K5G1D	4.2	EM EW	Data Collection Platform Commands Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	US&P
1544.55	100KG7D	2.2	EI	Search & Rescue Data		US&P Suitland, MD
1575.42 (Receive)	24M0G1D	—	EN	Global Positioning System (GPS) Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	US&P
1675.25 1675.55	400KG7D	5	EM	Data Collection Platform Report Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	Fairmont, WV Wallops Island, VA Suitland, MD US&P
1684	16M0G1D	62	EM	Rebroadcast Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	Fairmont, WV Wallops Island, VA Suitland, MD US&P
1693	8K00G1D 80K0G1D	1.5	EM	Command and Data Acquisition Telemetry Data		Fairmont, WV Wallops Island, VA Suitland, MD
1694.1	1M50G1D	30	EM	Emergency Managers Weather Information Network Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	Fairmont, WV Wallops Island, VA US&P
2027.1		95	TM	Emergency Managers Weather Information Network Data	Fairmont, WV Wallops Island, VA	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W
2032.75 2032.85	89K0G1D	4	TM TW	Data Collection Platform Commands Data	Fairmont, WV Wallops Island, VA	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W
2034.2	8K00G1D 128KG1D	310	TT	Command Data		
2036	1M50G3N	155	TT	Ranging Data		
	71K4G2D 84K0G2D			Command Data		

Downgrading Instruction	Classification	Page Number
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Figure 11 - GOES-NEXT Stage 1 page 1

Form NTIA-44 (3/91) CONTINUATION PAGE		Classification UNCLASSIFIED		System Geostationary Operational Environmental Satellites (GOES)-Next Series		
Frequency (MHz)	Emission	Mean Power (W)	Station Class (Stage 4)	Function	Transmit Locations	Receive Locations
2211.04	1M50G3N 4M92G2D 4M93G2N	1.5	ET	TT&C and Ranging Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	Fairmont, WV Wallops Island, VA
7216.6	17M0G1D	230	TM	Rebroadcast Data	Fairmont, WV Wallops Island, VA	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W
8220	180MG1D	14	EW	Raw Data	Space 60° W, 75° W, 89° 30' W, 105° W, 137° W	Fairmont, WV Wallops Island, VA

Section 2: SOURCE DOCUMENTS

Docket Number	Description of Document	Dated
SPS-20908/1	Commerce Request for Stage 1 System Review	March 18, 2015
SPS-21313/1	NTIA Preliminary Assessment	November 3, 2015

Section 3: SPECTRUM PLANNING SUBCOMMITTEE (SPS) RECOMMENDATIONS

The SPS reviewed this system under the provisions of Chapter 10 of the NTIA Manual, and noting that the system's name has been changed from "GOES V Satellite Network" to GOES-Next Series, and recommends that:

1. NTIA certify Stage 1 spectrum support for the GOES-Next Series, as specified in Section 1.
2. Commerce, for future stages of review, provide transmitter, receiver and antenna characteristics sufficient for NTIA to conduct a complete system review, in accordance with Part 10.8 of the NTIA Manual, and in particular, -3 dB, -20 dB, -40 dB and -60 dB emission bandwidths, frequency tolerances, harmonic levels, and antenna characteristics data.
3. Commerce:
   a. ensure that the downlink transmissions using the frequencies 468.75 MHz and 468.85 MHz for downlink transmissions, shall not exceed -152 dBW/m²/4 kHz and must operate on a secondary basis to stations operating in the fixed and mobile services, in accordance with Footnote US289 to the National Table of Frequency Allocations;
   b. coordinate with the World Meteorological Organization for operations of this system using the frequencies in the band 401.7-402.4 MHz, and at the frequencies 401.7 MHz, 401.85 MHz, 402 MHz, 402.4 MHz, 468.75 MHz, 468.85 MHz, 1675.25 MHz, 1675.55 MHz, 1684 MHz, 1693 MHz, 1694.1 MHz, 7216.6 MHz, and 8220 MHz;
   c. coordinate with non-federal terrestrial receiving stations at fixed sites for the Fairmont and Wallops Island earth station transmitters using the frequencies 2027.1 MHz, 2032.75 MHz, 2032.85 MHz, 2034.2 MHz, and 2036 MHz, in accordance with Footnote US346 to the National Table of Frequency Allocations;
   d. take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference in the band 1670-1690 MHz in accordance with Footnote US211 to the National Table of Frequency Allocations; and
   e. coordinate with the COSPAS/SARSAT program for operations using frequencies regarding emergency position indicating radio beacons in the bands 406-406.1 MHz and 1544-1545 MHz.

Distribution	Classification	Page Number
IRAC, SPS, FAS, EPS	UNCLASSIFIED	2 of 3

Figure 12 -- GOES-NEXT Stage 1 page 2

Form NTIA-44 (3/91) CONTINUATION PAGE	Classification UNCLASSIFIED	System Geostationary Operational Environmental Satellites (GOES)-Next Series

Section 3: SPS RECOMMENDATIONS

4. Commerce submit ITU Appendix 4 data to the Space Systems Subcommittee for international registration in a timely manner in accordance with Section 3.3.1 of the NTIA Manual.

5. Commerce submit coordination contours to the SPS for the Fairmont, WV earth station to transmit in the band 2025-2110 MHz and receive in the bands 1675-1710 MHz and 2200-2290 MHz; for the Wallops Island, VA earth station to transmit at the frequency 2036 MHz; and for both the Wallops Island, VA and Fairmont, WV earth stations to transmit in the band 7190-7235 MHz and receive in the band 7900-8500 MHz, in accordance with Section 8.3.13 of the NTIA Manual.

6. Commerce, for Stage 4 review, provide measurements of the emission levels in the 1164-1240 MHz and 1559-1610 MHz bands used by the Navstar Global Positioning System that are generated by transmissions in the frequency bands 390-413 MHz and 960-1710 MHz, in accordance with Section 8.2.55 of the NTIA Manual.

Name/Title of Recommending Official	Signature	Date
Binyam Tadesse SPS Vice Chairman		APR 20 2016

Section 4: NTIA CERTIFICATION

The band 1675-1695 MHz is part of the NTIA quantitative assessment (QA) of the agencies' actual use of the spectrum called for in the 2013 Presidential Memorandum entitled "Expanding America's Leadership in Wireless Innovation." The NTIA QA plan is contained in Appendix A of the Fourth Interim Progress Report on the Ten-Year Plan and Timetable available at http://go.usa.gov/PT6H. Each agency with current operations in the bands under consideration in the QA, along with any agency expecting to deploy, change, or cease operations of systems in the band are required to report to NTIA on their projected usage, termination, and future developments. Furthermore, this office advises Commerce that the President's budget proposals for the past few years have proposed repurposing for auction the 1675-1680 MHz band and introduction of new terrestrial mobile broadband systems in the band may have an impact on the supportability and compatibility of the subject system. The most recent proposal contained in the FCC's FY 2017 budget (available at p. 6 of https://apps.fcc.gov/edocs_public/attachmatch/DOC-337668A1.pdf), recognizes that any repurposing of this band would be "subject to sharing arrangements with Federal weather satellites" and that limited protection zones for the remaining weather satellite downlinks and alternative data broadcast systems would be developed if the proposal is enacted. The FCC also has pending a petition for rulemaking (RM-11681) proposing to initiate a rulemaking proceeding to allocate the 1675-1680 MHz band for non-federal terrestrial mobile use on a shared basis with federal users.

The Office of Spectrum Management concurs with the SPS recommendations in Section 3.

This office certifies Stage 1 spectrum support for this system.

Name/Title of Certifying Official	Signature	Date
Peter A. Tenhula Deputy Associate Administrator		APR 20 2016
Distribution: IRAC, SPS, FAS, EPS	Classification: UNCLASSIFIED	Page Number: 3 of 3

Figure 13- GOES-NEXT Stage 1 page 3

15.4 Radiosondes

Atmospheric soundings form the basis of all-weather modelling and forecasting. Atmospheric soundings in the USA are made with radiosondes (balloon-borne instruments for atmospheric measurements) utilizing the 1680 MHz frequency. Because of AWS-3, NOAA is relocating radiosondes operations from the 1675-1680 MHz frequency band to the 401.15-406 MHz frequency band to accommodate terrestrial broadband transmitters. This transition of radiosonde operations is expected to be completed around 2022, possibly later.

Radiosonde frequency assignments include 1676 MHz, 1678 MHz, 1680 MHz, and 1682 MHz. Radiosondes are operated out of multiple locations throughout the US&P. (NTIA, Department of Commerce, 2014)

16 Annex F – International Agreements

16.1 Europe: EUMETSAT

Formed in 1986, the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) is an international organization composed of 30 member states from across Europe that operates geostationary satellites over Europe and Africa and polar-orbiting satellites. NOAA and EUMETSAT signed a Long-Term Cooperation Agreement in August 2013, building on a 30-year partnership in geostationary, polar-orbiting, and ocean altimetry satellites that has brought tremendous cost-saving benefits and increased the robustness of our observing systems. (NOAA IIAD, 2016)

16.2 Japan: JMA

The Japan Meteorological Agency is Japan's operational weather forecasting and meteorological satellite agency. NOAA and JMA have mutual back-up arrangements for geostationary systems, and NOAA and JMA next-generation satellites will carry similar advanced imagers. JMA and NOAA actively participate in the Coordination Group for Meteorological Satellites. (NOAA IIAD, 2016)

16.3 Japan: JAXA

The Japan Aerospace Exploration Agency conducts space research and development from unmanned to manned space activities. NOAA has a longstanding partnership with JAXA, most recently providing for cooperation in JAXA's Global Climate Observation Mission–Water (GCOM-W1) for key observations on the water cycle. JAXA is a founding member of the Committee on Earth Observation Satellites (CEOS). (NOAA IIAD, 2016)

16.4 Europe: ESA

Formed in 1975, the European Space Agency is an independent international organization composed of 22 member states from across Europe. In addition to exploring our solar system and supporting human spaceflight through its astronaut corps, ESA has a robust Earth observation program. ESA is also launching and operating, in coordination with the European Union and EUMETSAT, a series of Sentinel satellite missions which will provide key Earth observation data to users around the world. (NOAA IIAD, 2016)

16.5 Taiwan: NSPO

The National Space Organization was established in 1991 to execute Taiwan's space program and develop technology infrastructure for space development. NOAA cooperates with NSPO on the FORMOSAT-3/COSMIC (Constellation Observing System for Meteorology, Ionosphere and Climate), a constellation of six satellites that launched in 2006 and demonstrated the use of Global Positioning System (GPS) radio occultation in an operational environment for weather prediction, space weather observation, and global change research. A follow-on mission, FORMOSAT-7/COSMIC-2, is under development. (NOAA IIAD, 2016)

16.6 France: CNES

NOAA works with the Centre National d'Études Spatiales (French Space Agency) in several areas. Since 1978, Argos, a data collection and location relay system administered under an agreement between NOAA and CNES, collects a wide variety of in situ measurements, including data on atmospheric pressure, sea temperature, ocean current velocity, animal migration patterns, and river water levels. In addition, NOAA works with CNES on the joint CNES-NASA TOPEX/Poseidon altimeter mission, initially launched in 1992 and expanded in 2008 with the launch of Jason-2 and again in 2016 with the launch of Jason-3. NOAA and EUMETSAT cooperate to operate the Jason-2 and Jason-3 satellites. (NOAA IIAD, 2016)

16.7 Canada: CSA

The Canadian Space Agency has been NOAA's partner since its founding in 1989. In 1991 NOAA and NASA partnered with CSA on the RADARSAT-1 (R-1) mission. The R-1 satellite was launched in 1995 and was operational until 2008 when the RADARSAT-2 (R-2) came online. NOAA and NASA continue to work with CSA on the replacement for R-2, the RADARSAT-Constellation mission (RCM). NOAA is also working closely with CSA on the proposed Polar Communication and Weather mission (PCW), also known as PolarSat. NOAA and CSA cooperate closely in GEO and other international space fora. (NOAA IIAD, 2016)

16.8 China: CMA

The China Meteorological Administration has been responsible for China's national meteorological services since 1994 and operates primary and backup geostationary satellites over Asia and the Pacific as well as several polar-orbiting satellites (morning and afternoon orbits). NOAA and CMA cooperate bilaterally through the Atmosphere Protocol of the U.S.-China Agreement for Science and Technology, originally signed in 1979. NOAA has welcomed CMA's willingness to accept leadership roles in key international bodies such as the Group on Earth Observations and the Committee on Earth Observation Satellites. (NOAA IIAD, 2016)

16.9 South Korea: KMA and KARI/KASI

The Korean Meteorological Administration provides weather forecasts and warnings. In 2010 KMA successfully launched its first weather satellite, COMS-1. KMA and NOAA cooperate under the KMA-NOAA Protocol on Cooperation in the Field of Atmospheric Science and Technology. NOAA/NESDIS and KMA's National Meteorological Satellite Center (NSMC) focus on cooperation in algorithm development, satellite product visualization, and technical use of data. The Korea Aerospace Research Institute (KARI) is the aeronautics and space agency of South Korea, and the Korea Astronomy and Space Science Institute (KASI) develops applications of space data. KARI and KASI are responsible for KOMPSAT-5, which offers Global Navigation Satellite System radio occultation (GNSSRO) data of interest to NOAA. (NOAA IIAD, 2016)

16.10 INDIA: ISRO AND MoES

The Indian Space Research Organization is the research and development wing of India's Department of Space. On 23 March 2012, NOAA and ISRO concluded and formally signed an Implementing Arrangement (IA) on Oceansat-2 collaboration. The IA codifies cooperation between the two agencies in ocean wind and ocean color activities. Access to these data have helped mitigate the loss of scatterometer data from NASA's QuikSCAT. NOAA also works with the Indian Ministry of Earth Sciences (MoES). NOAA and MoES signed an MOU for technical cooperation in Earth observations and Earth sciences in April 2008, and an Implementing Arrangement for INSAT-3D in October 2010. (NOAA IIAD, 2016)

16.11 EUROPE: EC

The European Commission (EC) is managing the EU's space programs. NOAA and the EC's Joint Research Centre have an Implementing Arrangement for cooperation in such areas as tsunami modeling and climate observation metadata. NOAA also is cooperating with the EC's Copernicus program, which collects data from sensors on water, land and from Sentinel satellites. Under the Copernicus Cooperation Arrangement signed by the United States and the EC in October 2016, NOAA will receive in synthetic aperture radar, altimetry, ocean color, and atmospheric chemistry data from the Sentinel missions. (NOAA IIAD, 2016)

16.12 AUSTRALIA: AIMS, UQ, CSIRO, AND BOM

NOAA has strong cooperation with several Australian organizations and agencies, including the Australian Institute of Marine Science (AIMS), the University of Queensland (UQ), the Commonwealth Scientific and Industrial Research Organization (CSIRO), and the Bureau of Meteorology (BOM). In September 2011, NOAA signed two MOUs—one with AIMS and one with UQ—for ocean and atmospheric scientific research and technological development activities. NOAA's cooperation with BOM is through an MOU for Technical Cooperation in Meteorology, Oceanography, and Hydrology led by the Weather Service. NOAA and BOM signed an Implementing Arrangement for collaboration on COSMIC-2 ground station operations in March 2016. (NOAA IIAD, 2016)

17 Annex G – GOES System Description

17.1 GOES Mission Goals

The goals of the Geostationary Operational Environmental Satellite (GOES) system program are to:

- Maintain continuous, reliable operational, environmental, and storm warning systems to protect life and property
- Monitor the earth's surface and space environmental conditions
- Introduce improved atmospheric and oceanic observations and data dissemination capabilities
- Develop and provide new and improved applications and products for a wide range of federal agencies, state and local governments, and private users.

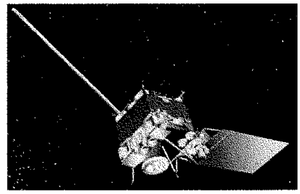
To address these goals, the National Weather Service (NWS) and the National Environmental Satellite Data and Information Service (NESDIS) of the National Oceanic and Atmospheric Administration (NOAA) established mission requirements for the 21st century that are the basis for the design of the GOES system and its capabilities. The GOES system functions to accomplish an environmental mission serving the needs of operational meteorological, space environmental, and research users.

To accomplish the GOES mission, the GOES spacecraft perform three major functions:

- **Environmental sensing** — Acquisition, processing, and dissemination of imaging and sounding data, space environment monitoring data, and measurement of the near-earth space weather.
- **Data collection** — Interrogation and reception of data from earth surface-based data collection platforms (DCPs) and relay of such data to the National Oceanic and Atmospheric Administration (NOAA) command and data acquisition stations.
- **Data broadcast** — Processed data relay (PDR) of environmental sensor data. The relay of distress signals from aircraft or marine vessels to the search and rescue satellite-aided tracking system (SARSAT). The continuous relay of weather facsimile (WEFAX/LRIT) and other meteorological data to small users and the relay of emergency weather information to Civil Emergency Managers.

Sensed data are acquired, processed, and distributed to users in real time to meet observation time and timeliness requirements, including revisit cycles. Remotely sensed data are obtained over a wide range of areas of the western hemisphere, encompassing the earth's disk, selected sectors, and small areas. Area coverage also includes the ability needed to relay signals and data from ground transmitters and platforms to central stations and end users. To accomplish the GOES system mission, space and ground segments are interconnected as shown in Figure 1, on page 14, above. (Boeing, 2005)

17.2 GOES-NOP (13-15) SYSTEM DESCRIPTION[6]



Launch of first satellite: May 24, 2006 (GOES-13, GOES-N prior to launch)

Projected End of Mission Life for series: 2025

General objective: Earth observation. Collects numerous atmospheric and surface parameters such as ice, snow, and vegetation; atmospheric temperatures; moisture, aerosol, and ozone distribution using instruments sensing in visible, near-IR, and thermal IR frequencies.

Space and Solar Instruments. Instrumentation on the GOES N-P series to monitor the highly variable solar and near-Earth space environment continues a long history of space weather observations collected by the GOES program.

The satellites also detect Emergency Locator Transmitters (ELTs), Emergency Position- Indicating Radio Beacons (EPRBs) and Personal Locator Beacons (PLBs) as part of the international COSPAS-SARSAT system.

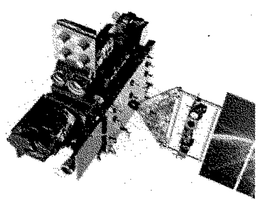
Orbit: Geostationary; locations: 75W and 135W. The on-orbit spare (parking orbit) is located at 105W.

Number of satellites: 3

Main ground station(s): US: Wallops Island, VA (primary); Greenbelt, MD (backup); Fairbanks, AK (backup); Boulder, CO (solar instrument data); Goldstone, CA (contingency support).

Direct Broadcast NOAA Ground Stations: Miami, FL; Norman, OK; Boulder, CO; Honolulu, HI; Anchorage, AK; Kansas City, MO (NOAA/NESDIS, 2016)

17.3 GOES-RSTU SYSTEM DESCRIPTION



See Figure 14 - Simplified GOES-RSTU System Architecture (NOAA GOES-R Program Office).

Launch of first satellite: November 19th, 2016 (see: http://www.goes-r.gov/)

[6] Prior to launch, GOES are identified with sequential letters (e.g. N, O, P). Once successfully launched, the satellite is given a sequential number (e.g. 13, 14, 15) for operational use.

Projected End of Mission Life for series: 2037

General objective: Earth observation: Collect numerous atmospheric and surface parameters such as ice, snow, and vegetation; atmospheric temperatures; moisture, aerosol, and ozone distribution using instruments sensing in visible, near-IR, and thermal IR frequencies.

Space and Solar Instruments: Instrumentation on the GOES-R series to monitor the highly variable solar and near-Earth space environment. The instruments that contribute to new services and products include: The Solar Imaging Suite (SIS), that will measure solar x-rays and solar extreme ultraviolet (EUV) radiation; and the energetic particle instruments, called the SEISS (Space Environment in Situ Suite), that will provide multiple measurements characterizing the charged particle population, including measurements of the electron, proton, and heavy ion fluxes. Finally, Earth's magnetic field will be measured by a magnetometer (MAG.)

Other: The satellites will also detect Emergency Locator Transmitters (ELTs), Emergency Position-Indicating Radio Beacons (EPIRBs), and Personal Locator Beacons (PLBs) as part of the international COSPAS-SARSAT system. GOES-R is the first satellite in the GOES series to use X-band.

Orbit: Geostationary; locations 75W and 137W (permanent operations) (Checkout and Extended Operations will be conducted at 89.5W for GOES-R) (Future satellites will be checked out at 89.5W or 105W and stored at 105W). Checkout and Extended operations for GOES-R will be approximately one year in duration.

Ground Segment: Ground support is critical to the GOES-R mission. The ground system will receive data from the GOES-R spacecraft and generate real-time GOES-R data products. This is accomplished via a core set of functional elements (mission management, product generation, product distribution and enterprise management/infrastructure), an antenna system and a product access element. The GOES-R Ground Segment (GS) will receive the raw data from GOES-R series spacecraft and generate Level 1b and Level 2+ products. The GS will also make these products available to users in a timely manner.

Number of satellites: 4

Main ground station(s): US: Wallops, VA (primary); Fairmont, WV (backup)

Direct Broadcast NOAA Ground Stations: Miami, FL; Norman, OK; Boulder, CO; College Park, MD; Honolulu, HI; Anchorage, AK; Kansas City, MO (NOAA/NESDIS, 2016)

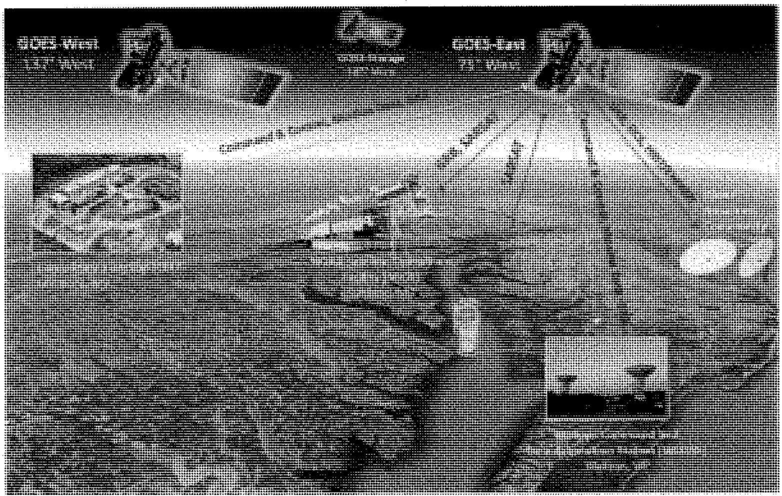


Figure 14 - Simplified GOES-RSTU System Architecture (NOAA GOES-R Program Office)

17.4 Description of Downlink Data Within the 1675-1680 MHz Band and Adjacent Bands

Table 6 - NOAA Meteorological-Satellite (GOES) Operations in the 1675-1695 MHz

Center Frequency (MHz)	Emission Bandwidth (MHz)	Function	Receive Locations
NOAA GOES N-P Meteorological Satellite Downlinks			
1676	5.200**	Sensor Data Link (SD)	Wallops Island, VA Greenbelt, MD Omaha, NE Fairbanks, AK
1681.478	0.400	Multi-Use Data Link (MDL)	Wallops Island, VA Greenbelt, MD Boulder, CO Omaha, NE
1685.7	4.220	Processed Data Relay (PDR)/GOES Variable (GVAR) (Broadcast)	US&P/Worldwide
1691.0	0.586	Low Rate Information Transmission (LRIT) (Broadcast)	
1692.7	0.027	Emergency Managers Weather Information Network (EMWIN) (Broadcast)	
1694.0	0.016	Command Data Acquisition (CDA)Telemetry	Fairbanks, AK Wallops Island, VA Greenbelt, MD Direct Readout Ground Stations (DRGS)
1694.5 1694.8	0.400 0.400	Data Collection Platform Report (DCPR)	
NOAA GOES-R* Meteorological Satellite Downlinks			
1690	12.000***	GOES-Re-Broadcast Data (GRB)	Western Hemisphere Suitland, MD
1683.3-1683.6	0.400	Data Collection Platform Report (DCP REPORT)	Worldwide Not including US&P

*The GOES-R program is under development and some center frequencies of the functions may change after the development and launch of the new GOES in the future.
**The emission of this link overlaps the 1670-1675 MHz band.
***The emission of this link overlaps the 1695-1710 MHz band.

17.5 GOES Role Within the National Infrastructure and Commerce

The Nation relies on NOAA's satellites and information as a key part of the global observing network. NOAA satellites and information services are a critical component of the observing, modeling, and computing resources needed to produce weather forecasts, watches, and warnings. NOAA satellites and the observations they gather are key national infrastructure that help protect lives and property and add immense value to the national economy. Uninterrupted flow of data from NOAA satellites is required to support two Department of Commerce Primary Mission Essential Functions[7], which have been approved by the National Continuity Coordinator, thus

[7] **PMEF DOC-2:** Collect and provide the Nation with critical intelligence data, imagery, and other essential information for predictive environmental and atmospheric modeling systems and space-based distress alert systems by operating NOAA-controlled satellites, communications equipment, and associated systems.

PMEF DOC-3: Provide the Nation with environmental forecasts, warnings, data, and expertise critical to public safety, disaster preparedness, all-hazards response and recovery, the national transportation system, safe navigation, and the protection of the Nation's critical infrastructure and natural resources. (SULLIVAN, 2011) making NOAA satellites not just NOAA priorities but also national priorities. NOAA is investing now to ensure that the Nation can continue to rely on these critical observations in the future. These observations and the derived products and services allow the Nation to prepare effectively for and deal with severe weather and other environmental phenomena. NOAA has been successfully developing, acquiring and managing its satellites and their operations for over 50 years. NOAA has adapted to meet new challenges and has learned from past setbacks. NOAA is poised to successfully meet its mission because of its excellent team in place with strengths in program management and the development and implementation of successful end-to-end systems and a strong partnership with NASA.

NOAA's GOES are used for short-term weather forecasting and severe storm tracking. These are the satellites that continuously watch over the Western Hemisphere providing images of severe weather events such as Hurricane Irene and Tropical Storm Lee that are seen by millions of Americans every day in their local or national media outlets. The currently operational GOES-P (now called GOES-15), the last of the current GOES series, was launched in early 2010. The next generation geostationary satellites series is the GOES-R series. The first GOES-R satellite, launched in November 2016, will go into operation and provide uninterrupted geostationary satellite coverage over the Western Hemisphere before the end of GOES-15's projected life.

Today, information is one of the first lines of defense employed to protect the health and wellbeing of citizens and to optimize the effectiveness of economic and social systems in response to the dynamics of ever-changing weather conditions. Information from GOES forms a critical component of today's capabilities. The planned GOES-R set of satellite innovations will further enhance this system.

Information from the GOES-R system has the potential to affect a vast array of human activities in the United States meaningfully. Even though the scope of activities is wide and quite apparent, valuation of information often is not as obvious. For example, hurricanes can have devastating impacts including loss of life, destruction of property, and disruption of economic operations. While improved information as to the path and intensity of each potential hurricane is of obvious interest, estimation of the value of that information can be difficult. Information has economic value only to the extent that it can improve the quality of decisions made. The instruments and services of GOES and GOES-R will have economic value if the information provided by those satellites can enable improved decision-making. Because of the widespread impact of weather events on a broad range of decisions, a vast number of entities are potentially affected, extending from individuals, to managers of commercial enterprises, to public and societal bodies.

In summary, the estimated potential benefits from improved information from GOES-R satellites for the following five specific types of economic activities are:

- Improved tropical cyclone forecasting resulting in more effective action to protect property and to enable evacuation of individuals residing in the path of the storm: $0.450 billion in 2015 (average of $130,000 per U.S. coastline mile from Maine to

Texas) and $2.4 billion from 2015 to 2027 (average of $690,000 per U.S. coastline mile from Maine to Texas)

- Enhanced aviation forecasting resulting in improvements in avoidable delays, value of passenger time avoided, avoidable repair costs due to volcanic ash, and avoidable risk of aircraft/life lost: $0.169 billion in 2015 and $0.768 billion from 2015-2027
- More accurate temperature forecasts contributing to improved energy demand expectations and savings in the electricity and natural gas sectors: $0.512 billion in 2015 and $2.56 billion from 2015-2027
- Enhanced forecasts leading to more efficient irrigation of crops — resulting in water savings, energy savings by not having to pump water, and revenue gains from selling excess water: $0.061 billion in 2015 and $1.09 billion from 2015-2027
- Improved forecasting of tropical cyclones resulting in reduced losses to the recreational boating industry: $0.031 billion in 2015 and $0.141 billion from 2015-2027
- Across the five activities, the combined annual value for 2015 exceeds $1.2 billion. The present value of the combined estimated benefits for the 2015-2027 period approaches $7 billion.

The magnitude of the economic benefits estimated for just the five types of economic activities mentioned above provides strong evidence of the potential for societal gain when the GOES-R satellites are available to provide improved information. (CENTREC, 2007)

17.6 NOAA Data Distribution Network

Currently, the GOES imagery and sensor data is transmitted to the WCDAS, relayed to the NSOF (where it is reformatted) and then retransmitted back up and through GOES and then provided, via the L-Band (1675-1695 MHz) to the end users. This data is also provided to users/customers through NOAAPort via the use of commercial communications satellites. Utilizing NOAAPort requires a commercial antenna and receiver available through any number of manufacturers. A majority of NOAAPort users are commercial, state and/or local municipalities who utilize the data for local weather forecasting.

It is not feasible at this time to change the data collection, processing and distribution of the GOES system. With GOES-R launching this year and GOES-S due to launch in 2017 or 2018, the current GOES-R related architecture will have to remain as it is through 2028. Alternative architectures with these understood limitations will be explored during the course of this study; however, as stated earlier, the focus may result on implementing changes commencing with the GOES-Next era of satellites and ground stations.

The use of NOAAPort by NOAA and other organizations may not consistently meet the requirement for timeliness of weather forecasting and prediction. The distribution of meteorological data via NOAAPort may be subject to outages and/or disruptions outside the realm of NOAA's control and responsibility due to use of commercial communications satellite systems.

Currently and for the foreseeable future, the delivery of the essential data for national weather prediction and forecasting is reliant on the use of the 1675 – 1695 MHz frequency band.

17.7 International Agreements

To meet the level of coverage needed, NOAA works with the international community, sharing the Earth observation data required for weather and environmental prediction on a full, free, and open basis.

NOAA is one of the world's leading providers of Earth observation data and yet NOAA receives three times more meteorological data from our international partners than we provide the international community. See Annex F – International Agreements, on page 57, for a synopsis of NOAA international agreements.

17.8 Joint International Missions with NOAA/NESDIS

NOAA supports several international programs that use the 1675-1695 MHz frequency band. These international programs enable users in the western hemisphere to acquire data from foreign spacecraft to support their operations. NOAA works with other nonfederal environmental satellite operators EUMETSAT, JMA, China Meteorological Administration, Russia's Federal Service for Hydrometeorology and Environmental Monitoring, India Meteorological Department, Korea Meteorological Administration and the World Meteorological Organization (WMO) to coordinate the frequencies and equator crossing times for all meteorological spacecraft. The most critical of these sites is the earth station in Hawaii collecting meteorological data from a Japanese geostationary satellite. The Japanese satellite provides critical upstream weather information that greatly improves forecast models for the United States and local forecast for the NWS Pacific Region. (NTIA, Department of Commerce, 2014)

NESDIS International and Interagency Affairs Division (IIAD) builds relationships with government organizations around the world. Figure 10 - International Agreements with NOAA/NESDIS for Sharing provides a listing of the some key satellite systems and regions that we work with. NESDIS and NOAA could not accomplish all they do without the scientific and data exchange with our partners built on years of cooperation and collaboration. (NOAA IIAD, 2016)

At the Signing Ceremony for the NOAA-EUMETSAT Long-Term Cooperation Agreement on 27 August 2014, EUMETSAT Director-General Alain Ratier said: "The partnership between EUMETSAT and NOAA has continuously developed over the last 30 years and taken a strategic dimension, bringing substantial benefits to Europe, the USA, and the worldwide user communities. With this agreement, we have established a policy framework to further develop our cooperation into the next decades." Global forecasts are only truly global because the global models get global data from satellites. By sharing satellite systems and data NOAA and EUMETSAT are able to provide twice as much of the information which is vital to help warn and protect citizens around the world. Hourly and three hourly data from the NOAA GOES-W & GOES-E geostationary satellites, are made available via EUMETCast and Direct Dissemination. (EUMETSAT, 2014)

17.9 Alternative Architectures Development

Alternative architectures for data distribution will be examined as part of this investigation. These alternative architectures will be required to ensure that NOAA responsibilities and mission requirements are maintained.

NOAA/NESDIS has in the past looked at alternative architectures to ensure that data is distributed in the most reliable, ubiquitous and cost effective manner possible. As part of the upgrade for GOES-R, the GOES-R Program Office authorized studies to examine the means for distributing the higher data content expected from the new version of GOES. DynCorp conducted some of these studies and in one report stated as part of the architectural alternatives in weather data distribution:

"GOES East provides distribution coverage throughout most of the continental United States and Canada, all of South America, and parts of Africa and Europe. GOES West provides coverage of most of CONUS and Canada, virtually all of the Pacific Ocean, and parts of Asia and Australia.

The current NOAA policy providing unencumbered access to the GVAR data is expected to continue into the future. Data distribution coverage areas are assumed to include the current areas of North America and South America, and parts of the Atlantic and Pacific Ocean regions, Africa and Europe.

The future quantity and quality of service for High-Resolution GOES data will depend on the type of transmission media employed. If distribution of data via satellite is the primary distribution method, the quality of service (as measured by availability of data and bit-error rate) should match the requirements of the most stringent primary users. These users will most likely continue to be the United States National Weather Service. If access is also via the Internet, the various user communities (i.e., high school students, amateur meteorologists, professional meteorologists, commercial weather broadcasters, etc.) will most likely have varying criteria for quality of service that can be readily addressed by an Internet distribution system.

It is possible, even probable, that the ultimate distribution system for High-Resolution GOES images will use a combination of satellite (GOES, commercial) and terrestrial transport techniques.

Terrestrial-based systems are primarily two-way systems, i.e., data flows between the provider and the subscriber in both directions. Unfortunately, high-speed terrestrial-based communications systems are not universally available. Many suburban and most rural locations do not have high speed access and, because of the limited profit potential for service suppliers, these prospective users will most likely not have this type of service during the time frame of interest.

System availability well in excess of the 99.0 percent requirement is normally easy to achieve using conventional commercial C-band satellite systems. C-band systems were specifically chosen because of their relative insensitivity to signal attenuation caused by precipitation versus other available satellite frequency bands.

Data latency caused by real-time satellite transmission systems can be divided into processing delays and propagation delays. High-speed real-time processing/formatting/error correcting delays are typically less than 10 milliseconds. Worse-case propagation delays are less than 300 milliseconds. For real-time high-speed satellite transmission systems, data latency is not an issue." (DynCorp Information Systems LLC, 2001)

Approximately three years ago, "NTIA concluded not to recommend the spectrum below 1695 MHz for sharing as part of the fast track process." was stated in the NTIA "Fast Track" report. Several paragraphs indicated the public safety applications in this band including, "Emergency managers and the public rely on information which is broadcast from NOAA satellites in the 1690-1695 MHz frequency band" for "flood gauge data", "severe weather warnings", and "tornado warnings." The "Fast Track" report also states, "If any portion of the spectrum below 1695 MHz is re-allocated, there will be an unmitigated loss of data to emergency personnel, and NOAA must immediately execute an eight to ten year, and a nearly $1-billion-dollar program to redesign and relocate its ground system. Because of significant unmitigatable user impacts, very high cost, and an eight to ten-year schedule, NTIA concluded not to recommend the spectrum below 1695 MHz frequency band for sharing." The rationale expressed in the NTIA report has not changed; 1675-1695 MHz frequency bandoffers critical time-sensitive safety of life and property information with large file sizes and geographically-diverse, broad coverage redistribution requirements that are needed with timely assured delivery. (NTIA, Department of Commerce, 2010)

The Spectrum Act required that 1695-1710 MHz frequency band be auctioned (and licenses issued) for commercial broadband usage by February 2015. NOAA studied the potential adjacent band interference to GOES-R downlinks from the wireless broadband usage in 1695-1710 MHz frequency band and prepared a February 2013 report stating that gain compression, intermodulation interference and even physical damage to GOES-R earth stations can occur from a single LTE handset in proximity to satellite receive equipment. To reduce the impact on this spectrum, the GOES-R program, at the direction of the DOC Secretary, redesigned the spacecraft spectrum plan to move L-band services down 3.4 MHz to avoid the 1695-1710 MHz frequency band. (Alion Science & Technology, 2013)

Wireless Industry representatives had recommended that the NOAA radiosonde program in 1675-1695 MHz be relocated to 401.15-406 MHz frequency band . The presence of radiosondes within the NOAA band was clearly seen as a strong incentive for allowing NOAA to continue its primary usage of 1675-1695 MHz frequency band; however, this is only one of the critical uses that benefit the U.S. economy as well as domestic and international industry by using geostationary weather satellites in this spectrum. When the radiosondes move out of the L-band, the entire 20 MHz band (1675-1695 MHz) needs to continue to be preserved, in alignment with the international meteorological community, for NOAA primary and protected use for both the current and future GOES missions that provide such a vital service to the nation. Sharing this band with the advance wireless service must account for the inherent risks associated with using this band jointly and ensure that critical meteorological data continues to be reliably received by the many users of the band – many of whom play an active role in maintaining public safety.

Meteorological data users require timely assured access to the satellite data. Since the initial question on use of the 1675-1710 MHz frequency band by the FCC, 282 users, mostly nonfederal, have responded. A very significant majority of whom expressed concern for the continued timely and reliable access to this band such that they can continue meeting their own responsibilities. Commercial aviation products are derived from satellite imagery and are essential for prediction of turbulence and volcanic ash events . Power generation utilities study predictions to pre-position crews in response to hurricane landfall events, and to plan for continuous electricity generation supply in the immediate future, since electrical power cannot easily be stored for later usage. Oil and gas exploration platforms in the Gulf of Mexico and surrounding US shores depend upon timely weather data derived from satellite broadcasts to plan for crew safety and to make evacuation decisions during severe weather events. It is important for this study to consider the necessary reliability and functionality of this band on the current nonfederal and federal users.

"The investment in the Houston EMWIN system is significant, and interference from other users of the spectrum on or around 1692.7 MHz would render the Houston EMWIN system inoperable, thus depriving one of America's largest metropolitan areas of a proven and valuable emergency weather warning and information service. ...While some might argue that the EMWIN downlink could be replaced by other means of delivery, including the Internet, those arguments are not viable. Internet delivery is subject to multiple failure points, especially during severe weather events, and is a costly alternative for many local government agencies, particularly considering that after the initial investment in receiving equipment, the satellite- based EMWIN data stream is free and results in no further cost to local taxpayers." - (Jim Robinson, 2010)

Space weather measurements and predictions have an impact on the aviation and utility industries. Commercial airlines flying polar routes between major international destinations can save hundreds of dollars per minute, and often hold more passengers and cargo by taking less fuel than on non-polar flight routes. Aircraft are required to stay in communications with Air Traffic Control throughout the entire flight route, and strong solar activity can cause HF radio blackouts in the polar region. When these are forecast to occur, the airlines must divert to routes that do not go above 82 degrees' north latitude. Electrical power generation operators know that a significant solar event can induce DC currents in the power grid that can cause damage. Utilities use information on predicted solar storms to prepare for outages and plan alternate transmission paths.

The user community is essentially unbounded as new applications for weather data are introduced and new receive systems are fielded. Users comprise a wide range of agencies and organizations - Federal to nonfederal, national to international, maritime to aviation. Distribution of NOAA weather information continues to grow—changing continuously and comprising a loosely knit network of weather organizations and commercial manufacturers.

"The Weather Channel, CNN, Fox News Channel, approximately half of the country's television stations, most of the country's commercial airlines and the vast majority of weather-sensitive businesses rely on WSI products and decisions support services. As such, WSI is recognized as the world's leading weather information resource and maintains the world's largest commercial meteorological database. ...The suite of imaging products derived from both NOAA satellites is a fundamental staple of WSI's missions- critical product offering, allowing for real-time analysis and detection of severe weather systems impacting customers throughout the Americas. ...Aggregate costs representing software development, systems integration and support of WSI products and services providing GOES satellite imagery total well over $ 2M to-date." (Paul D. Drewniak, 2010)

Universities access and use this streaming information to conduct weather research, develop algorithms for numerical weather prediction, and train future meteorologists. They perform a vital role in assisting NOAA to implement the latest developments in weather science as it builds the next generation systems. Manufacturers also are critical users of the data as they design earth station transmit and receive equipment and antennas, end user visualization and processing tools, and scientific instruments and platforms to measure the environmental parameters.

NOAA's National Weather Service (NWS) provides climate, water, weather forecasts and warnings to protect life and property and enhance the economy. It comprises 76 billion observations, 1.5 million forecasts and 50,000 warnings. A typical year brings 6 hurricanes, 1,000 tornadoes, 5,000 floods, 10,000 violent thunderstorms, drought conditions, 500 deaths, 5,000 injuries and about $14 billion in losses.

The information created by the next generation GOES-R system is many times that of the current generation satellites, and the communications infrastructure today is not adequate for dissemination to the multiple locations where the use of this data is required. Data volume continues to grow exponentially, with expectations that it will reach over 3500 Mbps by 2020.

This volume of data is required by the users to be provided in a reliable fashion such that they receive it without significant losses of information. This reliability is typically achieved by having at least two means of receiving the weather information. Satellite downlink via L-band continues to be considered the most reliable means for ensuring reception of data in both severe and normal weather conditions.

The GOES mission has continuously operated beginning with the launch of GOES-1 in 1975. The importance of the GOES missions continues to grow with the two-satellite constellation now serving the diverse array of users and needs. The existing legacy GOES series is expected to operate into 2025 and, as GOES-R comes online in the 2017 timeframe, higher data rates and improved capabilities will be introduced and extend the need for 1675-1695 MHz into 2036.

Subsequent GOES series will likely expand instrument coverage capabilities with higher data volumes, increased spatial resolution, and additional spectral resolution, such as may be produced by a hyperspectral sounder with the potential for thousands of bands. It is going to be important to preserve the NOAA RF spectrum now so that current mission operations can continue and future developments are possible.

With the importance of the information conveyed within this and the adjacent band, it is vital that this sharing study examine carefully all the myriad of uses that comprise the functionality of this meteorological band and ensure that the ongoing critical uses are not put at risk in this unique sharing challenge between the meteorological and advanced wireless services.

18 ANNEX H - ESTIMATED VALUE OF PIPELINE FUNDING

	[11] Remaining Population Impacted by Federal Use[5]	23%	Critical Input - what percent of population would be unable be served with the auctioned spectrum due to protection o imcumbent federal operations?
[12]=100%-[11]	Population Available for Auction After Relocation	77%	
	[13] Contiguous Coverage Discount[6]	75%	
	[14] Percent of Time Spectrum Available After Relocation[7]	100%	
[15]=[2]*[4]*[5]*[12]*[13]*[14]	Estimated Spectrum Value for Auction	$ 903,344,246	
	Estimated Net Benefit		
[16]=[15]-[10]	Estimated Net Auction Proceeds	$ 903,344,246	
	[17] Phase I Funding Request[8]	$ 12,013,000	
	[18] Years from Phase I Funding to Auction	8	
	[19] Treasure Rate[9]	2.1%	
[20]=[17]*(1+[19])^[18]	Time Value of Phase I Funding Request	$ 14,185,917	
	[21] Phase II Funding Request[8]	$ 0	
	[22] Years from Phase II Funding to Auction	0	
	[23] Treasure Rate[9]	2.4%	
[24]=[21]*(1+[23])^[22]	Time Value of Phase II Funding Request	$ 0	
	[25] Estimated SRF Relocation or Sharing Costs[10 11]	$ 262,000,000	Critical Input - to establish "net" you need to provide a high-estimated of SRF costs (transition plan) that might be reque for managing a sharing arrangement.
[26]=[16]-[20]-[24]-[25]	**Estimated Net Benefit**	**$ 627,158,329**	

[1] $1.00 MHz/Pop is an estimate assuming: (1) block could be used for downlink and potential paired with 1670-1675MHz, (2) spectrum is not otherwise encumbered by lower power restrictions, and (3) population density of available geography is similar to the nationwide average.

[2] Based on 2010 population for the FCC's partial economic areas (PEA). See https://www.fcc.gov/oet/maps/areas for spreadsheet of 2010 population by PEA. PEAs may be aggregated to EAs. Historically, FCC uses the decennial Census population for spectrum auctions. Doing so ensures that spectrum prices in terms of $/MHz-pops are the same basis over time. Consequently, this population is likely to be applicable for FCC auctions until the next decennial Census results are released in in 2022

[3] See Table 1 of Section 31.12 of OMB Circular No. A-11 (2016) at Section 31, page 9.

[4] Consult with NTIA when determining this entry.

[5] Agency must estimate the geography covered by spectrum use before and after implementation of the Pipeline Plan activity and convert geography to population cov using census tract data.

[6] Continous coverage discount: This represents the devaluation of the band, if the coverage is low. Empirical evidence suggests that there is additional value from availa a nationwide contiguous block, separate from the difference in population coverage, captured separately above. Bands that are not nationwide are expected to have a lower total value.

[7] Agency must estimate the time of use of the spectrum before and after implementation of the results of the Pipeline Plan activity.

[8] Funding should be requested in phases aligned with key decision points, as appropriate.

[9] See Appendix C of OMB Circular A-94 (2016). Select appropriate Treasury Rate based on the number of years from funding to auction. Round up to find appropriate ra

[10] Proivde a high-level rough order estimate of the expected cost to implement the results of the Pipeline Plan effort. Explain any assumptions and caveats associated w the identified costs in the plan.

[11] Value calculated based on AWS3 transition costs as submitted by Federal Agencies in 2014. Aggregated value converted from 2014 to 2016 dollars - however an expenditure rate over 8 years is unknown and a calculation of value for that period was not done. Does not include costs for other centers outside of AWS-3, such as ot federal, state, local and commercial facilities that would also assume costs for system modifications.

Figure 15 - Estimated Value of Pipeline Funding Using AWS3 Assumptions

To determine the remaining population impacted it was assumed that, at a minimum, a 150 Km radius protection zone will be needed around each of the federal earth stations listed in

Figure 16. The population within each protection zone was determined and used to calculate the remaining population impacted by federal use percentage.

Remaining Population Impacted by Federal Use Worksheet								
location		lat				lon		population in 150 Km radius
	degrees	min	sec		degrees	min	sec	
Miami, FL	25	44	5		80	9	45	5859647
Wallops Is, VA	37	56	45		75	27	45	2716351
Suitland MD	38	51	7		76	56	12	11996504
Fairbanks, AK	64	58	22		147	30	2	108297
Sacramento, CA	38	32	50		121	32	34	11626099
Boulder, CO	39	59	26		105	15	51	4528381
Boise, ID	43	35	42		116	13	49	777520
Rock Island, IL	41	31	4		90	33	46	2310930
Kansas City, MO	39	16	40		94	39	44	2893369
St Louis, MO	38	35	26		90	12	25	3811873
Columbus Lake, MS	33	32	4		88	30	6	1459801
Vicksburg, MS	32	20	47		90	50	10	1415108
Omaha, NE	41	20	56		95	57	34	1856656
Cincinnati, OH	39	6	10		84	30	35	6409108
Norman, OK	35	10	52		97	26	21	2126246
Knoxville, TN	35	57	58		83	55	13	3114943
Fairmont, WV	39	26	2		80	11	33	3769889
Guaynabo, PR	18	25	26		66	6	50	3675637
							Total	70456359
						U.S. census total pop	2010 pop	308745538
					% Remaining Population Impacted by Federal Use			22.82%

Figure 16 – Remaining Population Impacted by Federal Use

In determining the amount of cost for the relocation effort, the full amount of the DOC AWS-3 transition plan was used. While some items such as radiosondes costed in AWS-3 will not need to be funded, there are additional items that may need funding, such as mitigation measures for EMWIN (mobile) systems. Uncertainty in the results of the study with respect to mitigation requirements - mitigation approaches and risk aversion architectures are expected as part of the study and cannot be more accurately estimated until the study is completed, so a very crude ROM based on past activities.

Red Snapper

For years, I have heard from fishermen across the Gulf that NOAA's data for managing red snapper is inaccurate and insufficient, and leads to needlessly short seasons. Therefore, for each of the past two years, this Committee has provided funds to improve data collection for Red Snapper management.

Yet on May 2nd, the Department announced that this year's red snapper season for recreational fisherman in the Gulf of Mexico is only three days, a 67% reduction from last year's already unacceptably short season.

- How are you going to improve Red Snapper management and ensure fair access?

ANSWER:

On June 16, 2017, the Department of Commerce re-opened the 2017 private angler recreational season for 39 weekend days and holidays. The agreement reached between the Department of Commerce and the five Gulf of Mexico states is a significant step forward in building a new Federal-State partnership in managing the Gulf of Mexico red snapper stock. This represents a commitment from the States to restore a shared vision of uniform management that will benefit the long-term recovery of the red snapper stock while maximizing the economic benefits from recreational fishing in the Gulf region.

I appreciate your continued interest in fishery management in the southeastern United States.

- What steps are you taking to improve the data on Red Snapper in the Gulf of Mexico?

ANSWER:

First of all, thank you to this Committee for its leadership on this issue. The Department is committed to improve the data on red snapper in the Gulf of Mexico. NOAA continues to execute $10.0 million in funds appropriated in FY2016 by Congress to conduct an agency-independent abundance estimate for Gulf of Mexico red snapper, and this work is on track to be completed in FY 2019. NOAA recognizes the role of state reporting programs in managing the red snapper fishery and is actively working with the Gulf States to review and certify state data collection programs to increase the timeliness and precision of recreational catch estimates. In addition, NOAA has made recent improvements to the Marine Recreational Information Program (MRIP), developed in response to the recommendations of a 2006 National Academies of Science (NAS) review of recreational catch surveys.

In its 2017 review of MRIP, the NAS reviewed these changes to the general survey and found they constitute major improvements in statistical soundness of survey designs.

Councils

The National Marine Fisheries Service approves fishery management actions developed by regional fishery management councils through stakeholder input. The councils have the ability to develop innovative fishery management solutions in conjunction with fishermen, which can occur through cooperative research and data collection efforts.

Does the proposed budget provide the National Marine Fisheries Service the resources and authority needed to ensure that all options for fishery management are kept open to the regional councils?

ANSWER:

The President's FY 2018 Budget request includes funding for the National Marine Fisheries Service and regional fishery management councils to continue priority science and management efforts in support of U.S. fisheries. The agency will continue to work with regional councils and other partners to fulfill our statutory mandates.

Communications

What is the status of the Memorandum of Understanding on the Center for Advanced Communications between the National Institutes of Standards and Technology and the National Telecommunications and Information Administration?

ANSWER:

The MOU for the Center for Advanced Communications (CAC) expired on December 31, 2016. Because of the active and informal collaboration between the two organizations, there is not a current effort to formalize activities through a second MOU. NIST and NTIA staffs continue to collaborate in the area of wireless communications. Specifically, both organizations are co-sponsoring the 2017 International Symposium on Advanced Radio Technologies (ISART), which is focused on exploring the technical, regulatory and policy aspects of using portions of the millimeter-wave spectrum for future communication systems. In addition, NIST and NTIA are co-sponsoring a joint research project targeted on developing best practices for radio-frequency channel sounding measurements, which could lead to the improvement and validation of radio propagate-on models used by government agencies and the private sector. In addition, NIST continues to support the work and mission of the National Advanced Spectrum and Communications Network (NASCTN), which was established in 2015 by NIST, NTIA and DoD in order to organize a national network of Federal, academic, and commercial test facilities that provides testing, modeling and analysis necessary to develop and deploy spectrum-sharing technologies and inform future spectrum policy and regulations. Leadership of the NIST Communications Technology Laboratory (CTL) and the Institute for Telecommunication Sciences (ITS) continue to meet periodically to assess opportunities for spectrum-related collaboration, which can take various forms. Through this approach to collaboration the two labs are able to both adhere to their missions and have the flexibility to maximize collaboration where it is most beneficial.

The Honorable Hal Rogers

Subcommittee on Commerce, Justice, Science, and Related Agencies

Questions for the Record

U.S. Department of Commerce FY 2018 Budget Request

1. Economic Development

   Mr. Secretary, your own evaluations show Economic Development Administration (EDA) programs have exceeded performance goals in private sector investment in distressed communities and jobs created or retained as a result of EDA grants, yet you propose to eliminate this agency entirely. I am very concerned about how this proposal would affect rural America. I would appreciate your justification for cutting the EDA altogether, rather than pursuing constructive reform.

ANSWER:

In the last 52 years, EDA has made significant investments in economically distressed regions, based on locally-driven strategies and needs, that have spurred local innovation and entrepreneurship, created and saved jobs and leveraged private investments.

That said, the Administration's 2018 Budget prioritizes rebuilding the military and making critical investments in the Nation's security. It also identifies the savings and efficiencies needed to keep the Nation on a responsible fiscal path. Many difficult decisions and tradeoffs were necessary to reach the funding level provided in this budget, and the elimination of EDA is one of them. The President's budget aims to change the role and size of the Federal Government by prioritizing programs that serve the most critical functions and consolidating or eliminating duplicative or less critical programs.

The Administration's approach to economic development in general is to boost the entire economy through regulatory reform, unleashing energy resources, addressing unfair trade practices, and tax reform.

2. Assistance to Coal Mining Communities

   Within EDA, I am particularly troubled about the loss of money we have historically directed to assist to coal mining communities. My district has lost nearly 12,000 coal mining jobs alone since 2009. In the past, EDA has worked to assist these communities, but under your proposal this effort would vanish. Mr. Secretary, what will you do to continue helping communities that are dealing with mine layoffs?

ANSWER:

The Administration's general approach for helping all economically distressed communities, including coal communities, is to try to boost the entire economy through regulatory reform, unleashing energy resources, addressing unfair trade practices and tax reform.

3. Trade Adjustment Assistance

   Among the programs that EDA funds, the Trade Adjustment Assistance for Firms (TAA) program is small but effective in helping small manufacturers and smaller, often rural communities negotiate economic fluctuations. Over the past five years, TAA has assisted more than 700 companies and helped create or retain over 72,000 manufacturing jobs, with a return-on-investment of better than 10-to-1. With the President rightfully concerned about creating and preserving jobs, what is your justification for ending such a low-cost, high-return program?

ANSWER:

The Administration's 2018 Budget prioritizes rebuilding the military and making critical investments in the Nation's security. It also identifies the savings and efficiencies needed to keep the Nation on a responsible fiscal path. Many difficult decisions and tradeoffs were necessary to reach the funding level provided in this budget, and the elimination of EDA and its Trade Adjustment Assistance for Firms program is one of them. The President's budget aims to change the role and size of the Federal Government by prioritizing programs that serve the most critical functions and consolidating or eliminating duplicative or less critical programs.

The Administration's approach to economic development is to boost the entire economy through regulatory reform, unleashing energy resources, addressing unfair trade practices, and tax reform.

The Honorable Robert B. Aderholt

Subcommittee on Commerce, Justice, Science, and Related Agencies

Questions for the Record

Department of Commerce Budget Hearing

CFIUS

It's my understanding that export controls have not kept pace with new and emerging technologies, leading to scenarios where some of these new technologies may not have been captured by export control licensing requirements. Further, there is concern is that through clever investment schemes, come companies may have avoided CFIUS as well.

As you know, Chinese investment in the U.S. grew 350% between 2015 and 2016, with many investments being state-driven. Particularly with new and emerging technologies, many believe that our export control licensing process has not kept pace with new and emerging dual use technologies with military applications. The Defense Department's Defense Innovation Unit Experimental office has produced reports on these deficiencies. CFIUS reform is one avenue to address this issue.

Q. Can you please comment on deficiencies your department has identified with the CFIUS review process?

ANSWER:

The Department continues to actively participate in CFIUS, including reviewing every transaction that comes before the Committee. The Department is also participating with other CFIUS agencies in reviewing CFIUS procedures and authorities, and will continue to seek to work with the other CFIUS agencies to improve the functioning of the CFIUS process.

Q. Furthermore, can you please comment on any deficiencies in the export control process for new and emerging dual use technologies?

ANSWER:

Commerce maintains a robust export control system administered through the Export Administration Regulations (EAR). Determinations on what items should be subject to control under the EAR occurs through an interagency process that includes the Departments of Defense, Energy and State. The vast majority of items that are controlled under the EAR are controlled pursuant to the four multilateral export control regimes of which the United States is a member (the Wassenaar Arrangement, the Australia Group, the Missile Technology Control Regime, and the Nuclear Suppliers Group), so these determinations are also coordinated with our international partners.

Although keeping up with the pace of technological innovation in today's economy is a constant challenge for export control agencies, Commerce believes that the current system does allow for the control of new "emerging" technologies. Any of the agencies involved in the dual-use export control process can bring a proposal to control a particular item or technology if it believes that there is a compelling rationale to begin controlling the item. Because many of these technologies are not necessarily specific to the United States alone, this process is also used to bring proposals to the multilateral export control regimes so that other countries with similar technical capabilities also control the technology, thereby making the control more effective. Additionally, Commerce regularly seeks input from industry through our advisory councils through which the Department can stay updated on the state of the industry and the latest technical advances. We intend to pursue even closer cooperation with industry on identifying emerging and cutting edge technologies as early as possible in their development stages.
Commerce will continue to work with our interagency colleagues in this area to ensure that our control lists best capture the technologies that need to be controlled for export to protect U.S. national security.

Q. Are there specific areas where you believe CFIUS has failed and needs reform? If yes, please elaborate.

ANSWER:

The Department continues to actively participate in CFIUS, including reviewing every transaction that comes before the Committee. The Department is also participating with other CFIUS agencies in reviewing CFIUS procedures and authorities, and will continue to seek to work with the other CFIUS agencies to improve the functioning of the CFIUS process.

Currency Manipulation

Since 1994, the U.S. has failed to label any of our trading partners a currency manipulator. The Obama Administration chose to investigate antidumping and countervailing duty cases, while ignoring clear cases of currency manipulation by China. In mid-April, President Trump indicated that he will follow this same path.

Q. Is the Department of Commerce currently investigating currency manipulation in relation to any trade remedy cases? Or will the Department continue to turn a blind eye to this exploitation by our trading partners, leaving US manufacturing on an uneven playing field?

ANSWER:

While the authority to monitor and report on currency manipulation rests with the Department of the Treasury, Commerce separately has the authority to investigate an allegation that foreign producers and exporters are benefitting from currency-related foreign government subsidies, provided the allegation meets the requirements for initiating an investigation under the U.S. countervailing duty law. Any currency allegation made by a petitioning U.S. industry or its workers is carefully examined by Commerce based on the merits of and evidence underlying the allegation, in conformity with the initiation requirements under U.S. law. No such allegation, however, has been received from a petitioning U.S. industry or its workers with respect to any ongoing countervailing duty proceedings. Commerce is committed to vigorously enforcing the trade remedy laws to their fullest extent to ensure that U.S. companies, workers, farmers, and ranchers receive the relief from unfairly subsidized imports to which they are entitled under law.

Q. President Trump spoke throughout the 2016 campaign and into the first three months of his Administration about his determination to label China as a currency manipulator.

Then in mid-April, after meeting with China's President Xi Jinping, he abandoned this tenet. What exactly changed President Trump's mind about this issue?

ANSWER:

The authority to monitor and report on currency manipulation rests with the Department of the Treasury, and questions on this matter should be answered by Treasury.

Q. What is the status of the Commerce Department's country-by-country, product-by-product assessment of the causes of U.S. trade deficits? Will this study be completed early July, as anticipated? I understand that the study is expected to include "currency misalignments."

ANSWER:

The Commerce Department and U.S. Trade Representative study on significant trade deficits is nearing completion. The study covers a range of factors outlined in the Executive Order and noted by stakeholders in public comments and a public hearing, as well as analysis, by U.S. government issue experts.

ZTE

In March 2017, Chinese telecommunications firm ZTE reached a plea deal with the Department of Justice after it was found that the firm either directly or indirectly through a third company, shipped approximately $32 million of U.S. items to Iran between 2010 and 2016, in clear violation of U.S. law. In the plea deal, ZTE agreed to pay a fine of $892 million (with $300 million more if they violate the terms of the deal).

At the time, you were quoted as saying, "We are putting the world on notice: the games are over. Those who flout our economic sanctions and export control laws will not go unpunished—they will suffer the harshest of consequences." Attorney General Sessions stated, "ZTE Corporation not only violated export controls that keep sensitive American technology out of the hands of hostile regimes like Iran's—they lied to federal investigators and even deceived their own counsel and internal investigators about their illegal acts."

Q. We know about the fine, but a story posted by reporter Bill Gertz on May 31, 2017, indicates that ZTE did not cooperate with the investigation. When you removed ZTE from the list of companies restricted from selling to the U.S. government, did you require ZTE to cooperate and answer investigation questions which previously they had refused to answer?

ANSWER:

As clarification, our placing ZTE on the Entity list did not restrict ZTE from selling to the U.S. Government. Placement on the Entity List only restricted ZTE from receiving exports from the United States. It is accurate to say that ZTE did not cooperate for much of the investigation, but started cooperating with the investigation in March 2016 after the Department of Commerce placed the company on its Entity List. The Department of Commerce and the Department of Justice agreements with ZTE to settle the case both require ZTE to cooperate with future investigations. In fact, the Department's agreement with ZTE includes $300 Million in monetary penalties and a seven-year denial order that have been conditionally suspended based on, among other things, ZTE's cooperation on future investigative matters. If ZTE does not comply, the Department of Commerce can activate up to $300 Million in additional civil penalties and/or activate a denial of ZTE's export privileges and add ZTE to the Denied Persons List for a period of up to seven years. This listing would again impose severe restrictions on their ability to receive U.S. goods.

Q. What exact procedures is the Department of Commerce using to ensure that this situation doesn't happen again?

ANSWER:

The Department of Commerce imposed several significant measures to detect and deter future violations by ZTE. The Department created deterrence against future violations by suspending $300,000,000 of its penalty and imposed a suspended seven year denial order conditioned on no future violations of the Export Administration Regulations and ZTE's cooperation on future investigations. In summary, if ZTE were to violate the EAR and/or not cooperate with an investigation, the suspended portion of these severe penalties could be imposed. As part of the overall settlement, ZTE also accepted six years of monitoring and audit requirements. The monitoring will be led for the initial three years by a court-appointed monitor, former Texas State Judge James M. Stanton.

Q. If the Department of Defense has concerns about security, can the Department create its own list of restricted companies, or does that power reside only in the Department of Commerce?

ANSWER:

Your question about the Department of Defense's authority to create a list of restricted companies should be referred to the Department of Defense.

Q. According to recent reports, the identity of the U.S. company that ZTE used as a subcontractor has remained anonymous. Why has this company been allowed to remain anonymous?

ANSWER:

I can assure you that the Department of Commerce is committed to ensuring that U.S. and foreign companies, regardless of their size or location, comply with our export laws. I cannot comment on investigations that may possibly be pending. I assure you that our criminal investigators are aggressively pursuing any leads that may have arisen from our investigation of ZTE.

The Honorable Steven M. Palazzo

Subcommittee on Commerce, Justice, Science, and Related Agencies

Questions for the Record

Department of Commerce Budget Hearing

1. *Seafood Traceability*--As a part of the Food Safety and Modernization Act of 2011, Congress directed FDA and the USDA to establish a product tracing system to "receive information that improves the capacity of the Secretary to effectively and rapidly track and trace food that is in the United States or offered for import into the United States." Several pilots were conducted as a part of a private public partnership between FDA and IFT in 2011 to improve product tracing and establish recordkeeping requirements for high-risk foods to help in tracing products. These pilots were conducted in consultation with industry, USDA, state agencies, and consumer group. The study, released in march of 2013, established best practices and offered recommendations, yet FDA has not acted on them. NOAA published a final rule establishing the Seafood import Monitoring Program (SIMP) last December. I won't read the entire stated purpose but a shortened version reads: "establish for imports of certain seafood products, the reporting and recordkeeping requirements needed to prevent illegal, unreported and unregulated (IUU)-caught and/or misrepresented seafood from entering U.S. commerce." How can the FDA and NOAA Fisheries work together to harmonize their efforts to ensure there is not duplicative or overlapping regulations that will create confusion for private sector compliance?

ANSWER:

NOAA and FDA work cooperatively under the auspices of an operational MOU and are committed to ensuring that there is no duplication or overlap of process by the two agencies in their execution of mission. As the lead on the recent rule establishing the U.S. Seafood Import Monitoring Program (SIMP), NOAA worked with, among other agencies, FDA in the design and drafting of the regulation to ensure complimentary alignment with existing FDA regulations and requirements. With respect to seafood imports and in the context of SIMP, the FDA is primarily focused on food safety while NOAA and the SIMP rule are focused on the legality of the catch and truthful representation of fish and fish products from point of harvest to entry into U.S. commerce.

2. *NOAA's Cooperative Data and Rescue Services Program (CDARS)*--NOAA's Search and Rescue Satellite Aided Tracking (SARSAT) program is critical to the protection of human life. SARSAT relies on NOAA polar orbiting satellites to detect and locate mariners, aviators, and recreational enthusiasts in distress almost anywhere in the world at any time in almost any condition. Since my district is on the coast, our boaters and fishermen use Emergency Position Indicating Radio Beacons (EPIRBS) in the event of an emergency at sea to relay real-time information to ground-based search and rescue authorities. Since 1982, SARSAT is credited with saving over 39,000 people worldwide, including a total of 7,749 people in the U.S. Over 40 countries in addition to the United States currently rely on the SARSAT system for their search and rescue needs. Unfortunately, the NOAA satellites on which SARSAT relies are operating well past their design life and must be replaced. I understand NOAA will eventually move to a completely new constellation of mid-earth orbiting satellites to support SARSAT, but that system will not be in place for many years. To cover the gap, NOAA is relying on Cooperative Data and Rescue Services (CDARS). Through CDARS, NOAA will utilize a commercial satellite via the U.S. Air Force's Hosted Payload Program to launch new SARSAT instruments by 2021. I understand that NOAA requires at least $49 million in FY 18 to stay on target for a 2021 CDARS launch, however the President's proposed budget only includes $500,000. Can you explain how NOAA will keep CDARS on track with only 1% of the funding required for CDARS this year?

ANSWER:

The President's FY 2018 Budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, some difficult decisions needed to be made. NOAA will determine a new launch readiness date in FY 2018 as it re-plans the CDARS program. The new funding profile, which will be provided in the FY 2019 President's Budget request, will likely result in a launch readiness date beyond FY 2021, with an actual launch date to be determined after a provider is selected. Although a delay increases the risk of a gap in coverage, NOAA is actively investigating mitigation strategies for CDARS, and will continue to closely monitor the health of the current constellation. The current search and rescue system is supported by NOAA and partner assets. NOAA will continue to support these platforms as long as they are functioning. During FY 2018, NOAA will focus the program activities on how to achieve optimal sustained search and rescue coverage to meet mission needs. NOAA is considering options for future contributions to the Search and Rescue Satellite Aided Tracking (SARSAT) program, including augmenting the Medium Earth Orbiting Search and Rescue System (MEOSAR) ground system. While the full operating capability of the MEOSAR is not expected within the next few years, MEOSAR is already contributing to search and rescue efforts even in the system demonstration phase. NOAA will be looking at options for accelerating the deployment of the MEOSAR ground system to provide coverage for search and rescue services, as a way to minimize to the extent possible the risk of a gap in capability, and to prepare NOAA and the nation for the Full Operating Capability of the next generation MEOSAR search and rescue system.

3. *Asian Oyster Imports*-- Secretary Ross, fisheries are very important to my coastal district, economically and as part of our culture and way of life. Over the years, we have faced unfair competition from Asia in catfish, shrimp and crawfish products and your Department has been helpful in resolving these claims. Now, I am hearing from the Gulf of Mexico oyster industry that these same anti-competitive practices from Asia may be occurring in the frozen oyster and breaded oyster market and that our oyster industry is considering filling a petition for countervailing duty relief. Once that petition is filed, will you pledge to work with us along with Gulf oyster producers to investigate these claims?

ANSWER:

Under U.S. antidumping (AD) and countervailing duty (CVD) laws, U.S. industries that believe they are being injured or threatened with injury as a result of unfairly dumped or subsidized imports may petition the Department for relief by filing a request for the initiation of an AD and/or CVD investigation. If an investigation results in affirmative findings of dumping or subsidization and injury, duties may be imposed to offset the dumping or subsidization.

ITA can provide information on requesting a CVD investigation of the imports of frozen and/or breaded oysters. ITA helps U.S. industries understand the process to petition the U.S. government to initiate an investigation of the imports, provides guidance in compiling the information necessary for a petition, and reviews any draft petition to assist the U.S. industry in filing a petition.

The Department is committed to vigorously enforcing our trade remedy laws to address unfair trade practices that impact American workers and companies and will continue to employ all of the tools provided under the law to take swift action against harmful trade practices that put American companies at a disadvantage. If a petition is filed in this area and an investigation is initiated, the Department will certainly fully investigate the claims.

The Honorable Evan Jenkins
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Department of Commerce Budget Hearing

Jenkins Q1: The U.S. Department of Commerce's Market Development Cooperator Program (MDCP) program has been beneficial for several businesses and industries and has resulted in hundreds of millions of dollars of U.S. exports. The MDCP program has benefitted manufacturers and assisted them in entering overseas markets to the benefit of American companies and workers. Can you please elaborate on the reason for eliminating the MDCP program?

ANSWER:

The Market Development Cooperator Program (MDCP) has been an effective tool at helping small- and medium-sized firms export. However, due to the funding constraints, MDCP program did not fall within our funding priorities for further continuation.

Jenkins Q2: Technical standards play an important role in determining which overseas markets are more receptive to U.S. products and services and which markets have higher barriers of entry for U.S. exporters. Standards Attaches play an important role in aiding U.S. exporters and work within foreign markets to make sure American exporters remain competitive and have products that meet those standards. What are the plans to grow the number of Standards Attache positions and to fill the vacant spot such as in Saudi Arabia?

ANSWER:

Standards Attachés play an important role in helping U.S. companies compete internationally. Commerce has been working to grow support on standards for U.S. business exporters, and is working with the private sector to expand standards efforts. Towards this end, ITA has a standards team that provides training to enable client-facing staff better assist U.S. business clients on standards issues. ITA also tracks standards trends (such as the European Union's effort to spread its standards and regulatory system globally, and China's increasing activism in international standards development) and works to combat market barriers for U.S. exporters. We currently do not have specific plans to fill the vacant spot in Saudi Arabia. If the ability to fill more positions become available, it is a post we would highly consider.

The Honorable José E. Serrano
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on the Fiscal Year 2018 Budget Request of the Department of Commerce

1. Will President Trump's fiscal year 2018 request impact how the Commerce Department implements the funding appropriated for fiscal year 2017? Will the Department seek to prevent, inhibit, or slow down in any way the fiscal year 2017 funding obligations in programs, projects, or activities for which President Trump has requested reductions or eliminations for fiscal year 2018? What guidance has the Commerce Department issued to its bureaus on this subject?

ANSWER:

The FY 2018 President's Budget request will not impact how the Commerce Department implements funding appropriated for fiscal year 2017.

The Department will follow the Congressional intent set forth in the 2017 Omnibus bill (Public Law 115-31) and will not deviate from the fiscal year 2017 enacted levels for programs, projects, or activities which President Trump has requested reductions or eliminations for fiscal year 2018.

The Department has instructed bureaus to execute their FY 2017 funds as enacted by the Congress and has required its Bureaus to acknowledge this in their 2017 Spend Plans to our appropriations subcommittees.

2. In one section of his signing statement on the Fiscal Year 2017 Appropriations Act (Public Law 115-31), President Trump made reference to a list of programs and agencies—one of which is the Minority Business Development Agency—asserting that the provisions of this agency's appropriations would be treated "in a manner consistent with the requirement to afford equal protection of the laws under the Due Process Clause of the Constitution's Fifth Amendment." Please explain this. In what ways is the Commerce Department departing from the approach of previous Administrations of both parties, as far as implementation of the funding for the Minority Business Development Agency in fiscal year 2017? Secondly, did any White House or Office of Management and Budget officials or staff consult with Secretary Ross or other Commerce Department officials or staff about President Trump's signing statement?

ANSWER:

The signing statement was composed by the Justice Department/Office of Legal Counsel, with review by OMB OGC and the Office of White House Counsel. The text at the end concerning equal protection does not represent any change in the law, or Administration policy, with respect to MBDA or any of the other programs mentioned in the statement. Similar signing statements were issued by the prior Administration, e.g., *https://obamawhitehouse.archives.gov/the-press-office/statement-president-signing-hr-1105*. A signing statement on appropriations legislation issued by President Reagan likewise mentioned equal protection.

The Commerce Department implements the funding for the Minority Business Development Agency as well as its other bureaus according to the law as funds have been appropriated each year.

3. How much has the Commerce Department spent on outside contracts since January 20, 2017?

ANSWER:

The total amount of outside contracts since January 20, 2017 is $1,376,691,500.

Data Source: Federal Procurement Data System-Next Generation (FPDS-NG)

4. Since January 20, 2017, to what extent has the Commerce Department relied on outside contracts that were not fully and openly competed?

ANSWER:

The amount of outside contracts that were not fully and openly competed since January 20, 2017 is $243,500,207.

5. For the period of time beginning January 20, 2017, please provide a listing of all the Commerce Department's outside contracts of $50,000 or more, along with the purpose of each contract. In the listing, please indicate which contracts were not fully and openly competed.

ANSWER:

ATTACHMENT – DOC CONTRACTS OVER $50K.PDF

>= $50K

Date Signed	PIID	Full & Open	PSC Description	Obligated $
20-Jan	DOCEA133F12NC1265	Full & Open	SPECIAL STUDIES/ANALYSIS- REGULATORY	$100,000
23-Jan	DOC002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$250,000
23-Jan	DOC46PAPT1600370	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$61,909
23-Jan	DOCAB133F13CQ00031121A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$99,087
23-Jan	DOCDG133E10CN0229	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$864,731
23-Jan	DOCDG133W12CQ0008T0011	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$454,676
23-Jan	DOCEA133M17SU0065	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUITMENT: LODGING, HOTEL/MOTEL	$73,554
23-Jan	DOCEA133W17CN0021	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUITMENT: LODGING, HOTEL/MOTEL	$141,345
23-Jan	DOCSB130417AE0020	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$57,105
23-Jan	DOCSB134117SU0092	Not Full & Open	R&D- GENERAL SCI/TECH: MATHEMATICAL/COMPUTER SCIENCES (APPLIED RESEARCH/EXPLORATORY D	$89,930
23-Jan	DOCSS130117CC0007	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$231,697
23-Jan	DOCYA132317AE0006	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$184,166
23-Jan	DOCYB132317SE0033	Not Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$93,600
24-Jan	DOC17062	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$74,905
24-Jan	DOC17071	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$107,900
24-Jan	DOC44PAPT1611078	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$1,291,877
24-Jan	DOC45PAPT1700104	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$159,094
24-Jan	DOC46PAPT1700002	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$53,250
24-Jan	DOC46PAPT1700333	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$19,023,661
24-Jan	DOC46PAPT1700334	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$13,576,109
24-Jan	DOC46PAPT1700335	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$7,416,544
24-Jan	DOC56PAPT1600346	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$195,002
24-Jan	DOC56PAPT1600376	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$514,254
24-Jan	DOC56PAPT1600555	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$314,501
24-Jan	DOC56PAPT1700350	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$300,447
24-Jan	DOCBG133E14SU0932	Full & Open	ANTENNAS, WAVEGUIDES, AND RELATED EQUIPMENT	$56,802
24-Jan	DOCDG133E10CN0229	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,700,000
24-Jan	DOCDG133E10CQ0033T0017	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$100,000
24-Jan	DOCEA133F16SE1540	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- PLUMBING, HEATING, AND WASTE DISPOSAL EQUIPMENT	$774,582
24-Jan	DOCEA133W17SU0118	Full & Open	MISCELLANEOUS COMMUNICATION EQUIPMENT	$72,058
24-Jan	DOCRA133R16CQ0049T0001	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$56,250
24-Jan	DOCRA133W16CN0083	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$121,720
24-Jan	DOCRA133W17SE0250	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$56,844
24-Jan	DOCSB134114SE0144	Full & Open	SUPPORT- MANAGEMENT: OTHER	$57,537
24-Jan	DOCSB134117SU0104	Not Full & Open	EDUCATION/TRAINING- TUITION/REGISTRATION/MEMBERSHIP FEES	$85,712
24-Jan	DOCSB134213NC0289	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$374,272
24-Jan	DOCT0001	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$216,800
24-Jan	DOCT0003	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$241,000
24-Jan	DOCT006	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$192,943
24-Jan	DOCT0067	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,943,032
24-Jan	DOCWC133M16SE0466	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$112,200
24-Jan	DOCWC133W17SE0245	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$56,805
24-Jan	DOCYA132315CN0009	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$91,000
24-Jan	DOCYA132316CN0009	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,699,999
24-Jan	DOCYA132316CN0017	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$5,617,666
24-Jan	DOCYA132317CN0006	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$176,474
24-Jan	DOCYA132317NC0039	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$192,684
25-Jan	DOC001	Full & Open	HARDWARE, COMMERCIAL	$164,452
25-Jan	DOC002	Full & Open	HARDWARE, COMMERCIAL	$93,715
25-Jan	DOC17014	Full & Open	R&D- GENERAL SCI/TECH: MATHEMATICAL/COMPUTER SCIENCES (APPLIED RESEARCH/EXPLORATORY D	$343,657
25-Jan	DOC43PAPT1409037	Full & Open	IT AND TELECOM- TELEPROCESSING, TIMESHARE, AND CLOUD COMPUTING	$3,374,060
25-Jan	DOC45PAPT1300076	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$272,645
25-Jan	DOC45PAPT1730003	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$84,903
25-Jan	DOC45PAPT1730004	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$549,126
25-Jan	DOC56PAPT1600371	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$701,721
25-Jan	DOC56PAPT1600374	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$578,622
25-Jan	DOCAB133F16CQ0036T0007	Full & Open	SUPPORT- MANAGEMENT: OTHER	$92,740
25-Jan	DOCDG133E11BR0019C0019	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$254,902
25-Jan	DOCDG133W12CQ0008T0008	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$104,106
25-Jan	DOCEA133M17NC0132	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- RELOCATION: TRAVEL AGENT	$306,886
25-Jan	DOCEE133C17SU0123	Not Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$141,770
25-Jan	DOCSB133517SE0072	Full & Open	BOOKS AND PAMPHLETS	$86,795
25-Jan	DOCT0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$280,499
25-Jan	DOCT0013	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$264,381
25-Jan	DOCYA132315SE0035	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$53,400
26-Jan	DOC0001	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$86,892
26-Jan	DOC35375	Full & Open	HARDWARE, COMMERCIAL	$109,130
26-Jan	DOC46PAPT1700337	Full & Open	NEWSPAPERS AND PERIODICALS	$3,957,531
26-Jan	DOC46PAPT1750023	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$261,240
26-Jan	DOC50PAPT1500002	Not Full & Open	SUPPORT- PROFESSIONAL: SPECIFICATIONS DEVELOPMENT	$918,648
26-Jan	DOC50PAPT1600004	Not Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$1,507,865
26-Jan	DOC56PAPT1500512	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,648,660
26-Jan	DOC56PAPT1600313	Not Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- OTHER: OTHER	$60,000
26-Jan	DOCAB133013CN0073	Not Full & Open	HOUSEKEEPING- LANDSCAPING/GROUNDSKEEPING	$190,814
26-Jan	DOCC0010	Full & Open	SUPPORT- MANAGEMENT: OTHER	$284,807
25-Jan	DOCC0015	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$60,736
26-Jan	DOCDG133W10CN0111	Full & Open	SUPPORT- PROFESSIONAL: OPERATIONS RESEARCH/QUANTITATIVE ANALYSIS	$2,595,000

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
26-Jan	DOCEA133W14CN0027	Full & Open	HOUSEKEEPING- OTHER	$72,444
26-Jan	DOCRA133W16CN0093	Not Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$152,071
26-Jan	DOCSA130116CN0011	Not Full & Open	HOUSEKEEPING- OTHER	$1,217,717
26-Jan	DOCSB134112SU0369	Not Full & Open	TRANSPORT/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUIT: PURCH OF TRANSIT/PUBLIC TRANSPO	$459,000
26-Jan	DOCSB135015NC0600	Full & Open	SPECIAL STUDIES/ANALYSIS- SCIENTIFIC DATA	$127,865
26-Jan	DOCT0004	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$379,212
26-Jan	DOCT0005	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$647,988
26-Jan	DOCT0010	Full & Open	SUPPORT- MANAGEMENT: OTHER	$142,379
26-Jan	DOCYA132313NC0216	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$133,333
27-Jan	DOC0222	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$216,651
27-Jan	DOC17089	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$104,513
27-Jan	DOC45PAPT1611243	Full & Open	IT AND TELECOM- FACILITY OPERATION AND MAINTENANCE	$598,885
27-Jan	DOC46PAPT1750011	Full & Open	IT AND TELECOM- TELEPROCESSING, TIMESHARE, AND CLOUD COMPUTING	$1,023,222
27-Jan	DOC56PAPT1700352	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$508,649
27-Jan	DOCSA130114CC0020	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$53,040
27-Jan	DOCSB135016NC0372	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$94,500
27-Jan	DOCSB135017NC0090	Full & Open	TELEPHONE AND TELEGRAPH EQUIPMENT	$52,574
27-Jan	DOCT0004	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- AIRCRAFT AND AIRFRAME STRUCTURAL COMPONENTS	$54,640
27-Jan	DOCYA132314NC0205	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$75,000
27-Jan	DOCYA132316NC0280	Full & Open	SUPPORT- MANAGEMENT: OTHER	$898,934
30-Jan	DOC0003	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$376,748
30-Jan	DOC17085	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$161,232
30-Jan	DOC44PAPT1009008	Full & Open	IT AND TELECOM- FACILITY OPERATION AND MAINTENANCE	$2,910,614
30-Jan	DOC44PAPT1611059	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$203,705
30-Jan	DOC45PAPT1500448	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$235,261
30-Jan	DOC45PAPT1600335	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$1,398,200
30-Jan	DOC50PAPT1300007	Not Full & Open	SUPPORT- PROFESSIONAL: OTHER	$440,000
30-Jan	DOC56PAPT1700319	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$224,745
30-Jan	DOCAB133C16CN0014	Full & Open	R&D- NATURAL RESOURCE: MARINE AND OCEANOGRAPHIC (BASIC RESEARCH)	$229,200
30-Jan	DOCAB133E16NC0163	Full & Open	EDUCATION/TRAINING- OTHER	$403,745
30-Jan	DOCAB133M17CN0025	Full & Open	MARINE HARDWARE AND HULL ITEMS	$204,020
30-Jan	DOCDG133E10CQ0033T0017	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$240,000
30-Jan	DOCDG133W10CQ0042T0066	Full & Open	IT AND TELECOM- HELP DESK	$147,767
30-Jan	DOCEG133W17NC0143	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$87,862
30-Jan	DOCSS135017CC0009	Full & Open	LEASE OR RENTAL OF EQUIPMENT - INFORMATION TECHNOLOGY EQUIPMENT/SOFTWARE/SUPPLIES/S	$1,993,745
30-Jan	DOCT0017	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$314,866
30-Jan	DOCWC133W17SU0139	Not Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$79,400
31-Jan	DOC0002	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$54,000
31-Jan	DOC002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$928,019
31-Jan	DOC17084	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$122,300
31-Jan	DOC17088	Full & Open	LEASE OR RENTAL OF EQUIPMENT - INFORMATION TECHNOLOGY EQUIPMENT/SOFTWARE/SUPPLIES/S	$113,090
31-Jan	DOC17093	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$69,548
31-Jan	DOC17094	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$148,463
31-Jan	DOC17095	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$153,678
31-Jan	DOC17096	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$56,983
31-Jan	DOC44PAPT1400007	Full & Open	HOUSEKEEPING- GUARD	$11,419,946
31-Jan	DOC45PAPT1200231	Not Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$576,361
31-Jan	DOC45PAPT1700103	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$69,583
31-Jan	DOC45PAPT1730005	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$2,033,883
31-Jan	DOC45PAPT1740004	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$2,007,783
31-Jan	DOC45PAPT1740005	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$1,546,284
31-Jan	DOC45PAPT1750003	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$63,981
31-Jan	DOC45PAPT1750004	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$2,102,373
31-Jan	DOC45PAPT1750005	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$606,806
31-Jan	DOC45PAPT1750006	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$117,474
31-Jan	DOC46PAPT1700342	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$301,541
31-Jan	DOC50PAPT1400009	Not Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$552,749
31-Jan	DOC50PAPT1500009	Not Full & Open	NEWSPAPERS AND PERIODICALS	$2,383,673
31-Jan	DOC50PAPT1500022	Full & Open	SPECIAL STUDIES/ANALYSIS- OTHER	$1,600,000
31-Jan	DOC56PAPT1500592	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$469,517
31-Jan	DOC56PAPT1600351	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$679,001
31-Jan	DOC56PAPT1750003	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$189,629
31-Jan	DOC56PAPT1750017	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$798,624
31-Jan	DOCAB133017CN0027	Not Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$274,824
31-Jan	DOCAB133M10BU0037C0016	Full & Open	SUPPORT- MANAGEMENT: OTHER	$650,000
31-Jan	DOCAB133M17CN0026	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$267,923
31-Jan	DOCDG133W12CN0168	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$250,000
31-Jan	DOCEA133F13NC0796	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$904,632
31-Jan	DOCEA133W15BA0021C0001	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$247,621
31-Jan	DOCEA133W16BR0005T0001	Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$366,000
31-Jan	DOCEA133W17NC0147	Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$73,443
31-Jan	DOCEA133W17SU0146	Not Full & Open	BATTERIES, RECHARGEABLE	$139,700
31-Jan	DOCSB134112CQ0004	Full & Open	GASES: COMPRESSED AND LIQUEFIED	$171,361
31-Jan	DOCSB134116SE0176	Not Full & Open	SUPPORT- MANAGEMENT: ACCOUNTING	$185,400
31-Jan	DOCSB134117SE0065	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$74,447
31-Jan	DOCT0021	Full & Open	OTHER ENVIRONMENTAL SERVICES	$67,694
31-Jan	DOCWC133M17CN0022	Full & Open	MISCELLANEOUS AIRCRAFT ACCESSORIES AND COMPONENTS	$871,616

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
31-Jan	DOCWC133W15NC0501	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$51,901
31-Jan	DOCWO003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$638,820
31-Jan	DOCYA132317AE0008	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$163,598
31-Jan	DOCYA132317NC0041	Full & Open	SUPPORT- MANAGEMENT: OTHER	$327,500
31-Jan	DOCYA132317NC0042	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$856,967
1-Feb	DOC0232	Full & Open	SUPPORT- MANAGEMENT: OTHER	$61,380
1-Feb	DOC45PAPT1700115	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$86,440
1-Feb	DOC45PAPT1730006	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$471,917
1-Feb	DOCC0005	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$353,555
1-Feb	DOCDG133W05CQ1067T0081	Full & Open	COMMUNICATIONS SECURITY EQUIPMENT AND COMPONENTS	$2,587,509
1-Feb	DOCDG133W12CQ0010T0012	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,067,558
1-Feb	DOCSS132317NC0043	Full & Open	SUPPORT- MANAGEMENT: OTHER	$6,737,598
1-Feb	DOCT0008	Not Full & Open	MAINTENANCE OF GOVERNMENT-OWNED GOVERNMENT-OPERATED (GOGO) ENVIRONMENTAL LABO	$131,396
1-Feb	DOCT0016	Full & Open	IT AND TELECOM- HELP DESK	$441,346
1-Feb	DOCT0028	Full & Open	SUPPORT- MANAGEMENT: OTHER	$69,734
1-Feb	DOCYA132316SE0006	Not Full & Open	LEASE OR RENTAL OF EQUIPMENT- GROUND EFFECT VEHICLES, MOTOR VEHICLES, TRAILERS, AND CYCL	$306,000
1-Feb	DOCYA132317NC0044	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$57,596
1-Feb	DOCYA132317NC0045	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$88,133
1-Feb	DOCYB132317SU0015	Full & Open	PAPER AND PAPERBOARD	$164,773
2-Feb	DOC006	Full & Open	OFFICE SUPPLIES	$193,000
2-Feb	DOC35374	Full & Open	HARDWARE, COMMERCIAL	$87,304
2-Feb	DOC40PAPT1611075	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$158,950
2-Feb	DOC46PAPT1650051	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$398,446
2-Feb	DOC46PAPT1750024	Full & Open	SUPPORT- ADMINISTRATIVE: INFORMATION RETRIEVAL	$145,800
2-Feb	DOC56PAPT1700319	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$250,800
2-Feb	DOCAB133F16CQ0036T0005	Full & Open	SUPPORT- MANAGEMENT: OTHER	$63,445
2-Feb	DOCC0002	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$61,187
2-Feb	DOCDG133E09CN0094	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$48,000,000
2-Feb	DOCEE133E17SE0278	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$145,370
2-Feb	DOCRA133R17BA0026C0001	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$571,183
2-Feb	DOCRA133R17BA0026C0002	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$283,204
2-Feb	DOCRA133R17BA0026C0003	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$59,000
2-Feb	DOCSA130115CT0021	Full & Open	HOUSEKEEPING- GUARD	$84,354
2-Feb	DOCSB134117NC0105	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$62,994
2-Feb	DOCSB134117SU0107	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$63,631
2-Feb	DOCT0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$376,936
2-Feb	DOCYA132316NC0218	Full & Open	SUPPORT- MANAGEMENT: OTHER	$96,000
3-Feb	DOC44PAPT1711050	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$274,592
3-Feb	DOCAB133F15CQ0014000SB	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$77,219
3-Feb	DOCSB134117NC0122	Full & Open	OFFICE FURNITURE	$343,888
3-Feb	DOCST133016NC0849	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$161,720
3-Feb	DOCT0037	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$936,516
3-Feb	DOCWO005	Full & Open	SUPPORT- MANAGEMENT: OTHER	$2,000,000
6-Feb	DOC17104	Full & Open	IT AND TELECOM- PROGRAMMING	$91,258
6-Feb	DOC44PAPT1711038	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$105,293
6-Feb	DOC44PAPT1711043	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$272,056
6-Feb	DOC44PAPT1711046	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$150,815
6-Feb	DOC44PAPT1711049	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$237,355
6-Feb	DOC56PAPT1600532	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$142,907
6-Feb	DOC56PAPT1700351	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$119,020
6-Feb	DOCDG133W05CQ1067T0018	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$195,329
6-Feb	DOCDG133W05CQ1067T0023	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$61,525
6-Feb	DOCDG133W05CQ1067T0035	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$302,223
6-Feb	DOCDG133W05CQ1067T0055	Full & Open	COMMUNICATIONS SECURITY EQUIPMENT AND COMPONENTS	$67,225
6-Feb	DOCEG133W17NC0151	Full & Open	INFORMATION TECHNOLOGY INPUT/OUTPUT AND STORAGE DEVICES	$107,990
6-Feb	DOCST133016NC0329	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$60,000
6-Feb	DOCWO001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,680,000
6-Feb	DOCYA132316NC0187	Full & Open	SUPPORT- MANAGEMENT: OTHER	$249,983
7-Feb	DOC17103	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$75,888
7-Feb	DOC17105	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$231,515
7-Feb	DOC46PAPT1700003	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$97,500
7-Feb	DOC56PAPT1750016	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$174,993
7-Feb	DOCEA133M17SU0166	Full & Open	CHAIN AND WIRE ROPE	$60,555
7-Feb	DOCRA133R15CN0023	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$192,018
7-Feb	DOCT0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$260,982
7-Feb	DOCWE133F17NC0169	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$98,470
7-Feb	DOCYA132314NC0128	Full & Open	SUPPORT- MANAGEMENT: OTHER	$499,880
7-Feb	DOCYA132315NC0083	Full & Open	SUPPORT- MANAGEMENT: OTHER	$215,000
7-Feb	DOCYA132317NC0046	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$52,000
8-Feb	DOC44PAPT1711048	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$308,122
8-Feb	DOC44PAPT1711051	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$314,561
8-Feb	DOC44PAPT1711052	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$305,949
8-Feb	DOC45PAPT1700116	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$201,989
8-Feb	DOC50PAPT1200041	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$2,087,915
8-Feb	DOC50PAPT1200042	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$3,219,935
8-Feb	DOC50PAPT1200043	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$3,003,761
8-Feb	DOC56PAPT1600539	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$6,987,600

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
8-Feb	DOCC0001	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$706,211
8-Feb	DOCDG133W05CQ1067T0022	Full & Open	IT AND TELECOM- PROGRAMMING	$333,000
8-Feb	DOCGS00P07BSD0527DG133E11NC0979	Not Full & Open	UTILITIES- ELECTRIC	$100,000
8-Feb	DOCSB134117NC0107	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$1,691,910
8-Feb	DOCSB135017NC0128	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$73,010
8-Feb	DOCST133014SU1352	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$255,474
8-Feb	DOCST133015NC0177	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$94,764
8-Feb	DOCYA132316CN0009	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$179,999
8-Feb	DOCYB132317NC0023	Full & Open	OFFICE DEVICES AND ACCESSORIES	$125,000
9-Feb	DOC0001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$500,000
9-Feb	DOC0004	Full & Open	SUPPORT- MANAGEMENT: OTHER	$436,343
9-Feb	DOC001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$144,626
9-Feb	DOC17102	Full & Open	HOUSEKEEPING- WASTE TREATMENT/STORAGE	$78,008
9-Feb	DOC56PAPT1600392	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$459,946
9-Feb	DOCAB133W13CN0024	Not Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$484,929
9-Feb	DOCC0001	Full & Open	EDUCATION/TRAINING- GENERAL	$59,786
9-Feb	DOCDG133E10CQ0034T0004	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$3,866,535
9-Feb	DOCDG133E13NC0167	Full & Open	IT AND TELECOM- IT STRATEGY AND ARCHITECTURE	$1,006,392
9-Feb	DOCEA133F15NC0316	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$104,967
9-Feb	DOCEA133W15NC0127	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$265,838
9-Feb	DOCEE133E17SE0310	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$137,221
9-Feb	DOCRA133W17ST0006	Not Full & Open	UTILITIES- ELECTRIC	$98,183
9-Feb	DOCWC133F16SE0523	Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$55,716
9-Feb	DOCYB132317SE0039	Not Full & Open	LEASE/RENTAL OF PARKING FACILITIES	$60,000
10-Feb	DOC17108	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$99,298
10-Feb	DOC56PAPT1600519	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$253,399
10-Feb	DOC56PAPT1750023	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$109,155
10-Feb	DOCAB133C12CQ0010T0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$281,000
10-Feb	DOCAB133C14NC0184	Full & Open	SUPPORT- MANAGEMENT: OTHER	$2,449,430
10-Feb	DOCAB133M10BU0037C0001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$128,029
10-Feb	DOCEA133C17NC0186	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$117,208
10-Feb	DOCEA133F12NC1690	Full & Open	OTHER ENVIRONMENTAL SERVICES	$226,968
10-Feb	DOCEA133M17NC0132	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- RELOCATION: TRAVEL AGENT	$57,048
10-Feb	DOCEG133F16NC0292	Full & Open	SUPPORT- MANAGEMENT: OTHER	$100,000
10-Feb	DOCEG133W17NC0160	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$1,223,802
10-Feb	DOCRA133M17NC0184	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$70,906
10-Feb	DOCT0018	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$700,000
10-Feb	DOCT0068	Full & Open	SUPPORT- MANAGEMENT: OTHER	$2,336,715
10-Feb	DOCWC133R17SU0143	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$75,000
10-Feb	DOCWE133F17SU0176	Full & Open	INFORMATION TECHNOLOGY INPUT/OUTPUT AND STORAGE DEVICES	$109,912
10-Feb	DOCWO001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$327,264
10-Feb	DOCWO003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$350,000
10-Feb	DOCYA132314CN0029	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$58,250
10-Feb	DOCYA132314NC0038	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$100,000
10-Feb	DOCYA132314NC0196	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$425,000
10-Feb	DOCYA132317NC0049	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$62,613
13-Feb	DOC0002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$321,000
13-Feb	DOC56PAPT1700356	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$142,753
13-Feb	DOCDG133E10CQ0033T0019	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$123,472
13-Feb	DOCEG133C15CN0058	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$77,625
13-Feb	DOCSB134117NC0116	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$505,845
13-Feb	DOCSS130117CC0009	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$410,166
13-Feb	DOCST133016CT0007	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$71,722
13-Feb	DOCT0022	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$150,561
13-Feb	DOCT0033	Full & Open	SUPPORT- MANAGEMENT: OTHER	$544,525
13-Feb	DOCT0041	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$53,561
13-Feb	DOCYA132313NC0010	Full & Open	IT AND TELECOM- IT STRATEGY AND ARCHITECTURE	$651,646
14-Feb	DOC17066	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$204,069
14-Feb	DOC17110	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$110,423
14-Feb	DOC17114	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$145,869
14-Feb	DOC46PAPT1700338	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$327,933
14-Feb	DOC50PAPT1500020	Not Full & Open	SUPPORT- MANAGEMENT: FINANCIAL	$1,077,830
14-Feb	DOC56PAPT1750002	Not Full & Open	SUPPORT- PROFESSIONAL: OTHER	$399,408
14-Feb	DOC56PAPT1750011	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$666,799
14-Feb	DOC56PAPT1750015	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$815,054
14-Feb	DOCAB133F15CQ0031T0006	Full & Open	SUPPORT- MANAGEMENT: OTHER	$165,973
14-Feb	DOCAB133W13CN0007	Not Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$422,218
14-Feb	DOCC0004	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$106,946
14-Feb	DOCC0005	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$50,214
14-Feb	DOCC0008	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$212,396
14-Feb	DOCDG1133W10CQ0050T0026	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$240,000
14-Feb	DOCDG133W05CQ1067T0002	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$4,260,253
14-Feb	DOCDG133W05CQ1067T0004	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$1,022,015
14-Feb	DOCRA133C17SE0270	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$147,354
14-Feb	DOCRA133R16CQ0059D0003	Full & Open	BUOYS	$189,024
14-Feb	DOCSB134117NC0104	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$456,775
14-Feb	DOCSB134117NC0115	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$623,715

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
14-Feb	DOCSP133E17SU0165	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$151,060
14-Feb	DOCST133017NC0180	Full & Open	IT AND TELECOM - ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$371,500
14-Feb	DOCT0003	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$889,727
14-Feb	DOCT0006	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$19,000,000
14-Feb	DOCT0007	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$11,431,425
14-Feb	DOCT0040	Full & Open	BATTERIES, RECHARGEABLE	$68,466
14-Feb	DOCWC133M16CN0022	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- AIRCRAFT AND AIRFRAME STRUCTURAL COMPONENTS	$342,947
14-Feb	DOCYA132315NC0174	Full & Open	SUPPORT- MANAGEMENT: OTHER	$293,000
14-Feb	DOCYA132315NC0234	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$119,556
14-Feb	DOCYA132316CN0017	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$14,837,839
15-Feb	DOC17111	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$125,937
15-Feb	DOC45PAPT1600251	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$507,587
15-Feb	DOC56PAPT1700349	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,868,743
15-Feb	DOC56PAPT1750024	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$498,144
15-Feb	DOCBG133R17NC0194	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$67,236
15-Feb	DOCC0005	Full & Open	SUPPORT- MANAGEMENT: OTHER	$154,727
15-Feb	DOCDG133W12CQ0010T0028	Full & Open	SUPPORT- MANAGEMENT: OTHER	$288,327
15-Feb	DOCEA133W17NC0148	Full & Open	SUPPORT- MANAGEMENT: OTHER	$489,900
15-Feb	DOCSA130114NC0169	Full & Open	IT AND TELECOM- HELP DESK	$148,352
15-Feb	DOCT0051	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,692,702
15-Feb	DOCYB132313NC0279	Full & Open	IT AND TELECOM- TELEPROCESSING, TIMESHARE, AND CLOUD COMPUTING	$810,000
16-Feb	DOC001	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$123,280
16-Feb	DOC0230	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$97,508
16-Feb	DOC0239	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$57,107
16-Feb	DOC0240	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$161,990
16-Feb	DOC17058	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$147,392
16-Feb	DOC17116	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$80,671
16-Feb	DOC17117	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$155,797
16-Feb	DOC56PAPT1600412	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$476,128
16-Feb	DOCAB133F15CQ00140006E	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$263,258
16-Feb	DOCAB133F16NC0208	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$105,795
16-Feb	DOCC0002	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$300,000
16-Feb	DOCCO004	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$400,000
16-Feb	DOCDG133E10CQ0033T0017	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$750,000
16-Feb	DOCDG133W05CQ1067T0022	Full & Open	IT AND TELECOM- PROGRAMMING	$1,335,387
16-Feb	DOCEA133F16CN0153	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$61,555
16-Feb	DOCEG133W17NC0166	Full & Open	IT AND TELECOM- CYBER SECURITY AND DATA BACKUP	$2,673,828
16-Feb	DOCEG133W17NC0201	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$134,998
16-Feb	DOCSB134117SU0101	Not Full & Open	MISCELLANEOUS SPECIAL INDUSTRY MACHINERY	$96,007
16-Feb	DOCT0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$94,060
16-Feb	DOCWC133M14CN0037	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- MISCELLANEOUS	$72,517
16-Feb	DOCWC133W13CN0117	Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$81,983
16-Feb	DOCWC133W15CN0050	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRIC WIRE AND POWER DISTRIBUTION EQUIPMENT	$187,172
16-Feb	DOCWO004	Full & Open	SUPPORT- MANAGEMENT: OTHER	$904,804
16-Feb	DOCYA132117NC0050	Full & Open	FLOOR COVERINGS	$205,818
17-Feb	DOC17112	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$105,676
17-Feb	DOC43PAPT1511130	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$134,928
17-Feb	DOC45PAPT1611243	Full & Open	IT AND TELECOM- FACILITY OPERATION AND MAINTENANCE	$751,311
17-Feb	DOCRA133R13CN0139	Not Full & Open	SPECIAL STUDIES/ANALYSIS- AIR QUALITY	$185,680
17-Feb	DOCT0007	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,454,300
17-Feb	DOCT0036	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$140,000
17-Feb	DOCYA132316NC0027	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$7,000,000
17-Feb	DOCYB132317SE0042	Not Full & Open	HOUSEKEEPING- OTHER	$124,158
20-Feb	DOC45PAPT1700125	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$50,063
21-Feb	DOC35376	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$94,123
21-Feb	DOC44PAPT1711040	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$497,836
21-Feb	DOC44PAPT1711041	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,737,084
21-Feb	DOC44PAPT1711042	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,787,453
21-Feb	DOC44PAPT1711044	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,989,992
21-Feb	DOC44PAPT1711045	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$2,147,809
21-Feb	DOC44PAPT1711047	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$2,118,541
21-Feb	DOC56PAPT1750019	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$5,762,306
21-Feb	DOCC0017	Full & Open	SUPPORT- MANAGEMENT: OTHER	$184,982
21-Feb	DOCC0020	Full & Open	OTHER ENVIRONMENTAL SERVICES	$127,381
21-Feb	DOCC0075	Full & Open	EDUCATION/TRAINING- OTHER	$57,248
21-Feb	DOCEA133C17NC0204	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$73,040
21-Feb	DOCEA133M17SE0329	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,635,172
21-Feb	DOCRA133R12CQ0021T0029	Not Full & Open	SUPPORT- PROFESSIONAL: OTHER	$79,308
21-Feb	DOCRA133R17SE0326	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$140,000
21-Feb	DOCRA133R17SU0194	Not Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$148,925
21-Feb	DOCRA133W13CN0126	Not Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$64,045
21-Feb	DOCSS130117CC0010	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$2,452,327
21-Feb	DOCT0006	Not Full & Open	OTHER ENVIRONMENTAL SERVICES	$450,000
21-Feb	DOCT0014	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$5,285,258
21-Feb	DOCYA132317NC0042	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$218,960
21-Feb	DOCYA132317NC0053	Full & Open	HARDWARE, COMMERCIAL	$150,014
22-Feb	DOC0005	Full & Open	SUPPORT- MANAGEMENT: OTHER	$917,000

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
22-Feb	DOCAB133E16CN0064	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$50,000
22-Feb	DOCDG133W12CQ0010T0018	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$192,425
22-Feb	DOCEA133F13NC0796	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$148,888
22-Feb	DOCEA133W15BA0035C0007	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$86,054
22-Feb	DOCSB134117SU0137	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$341,860
22-Feb	DOCST133016NC0632	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$137,516
22-Feb	DOCST133017CN0032	Not Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$54,900
22-Feb	DOCST133017NC0210	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$56,736
22-Feb	DOCT0052	Full & Open	SUPPORT- MANAGEMENT: OTHER	$101,650
22-Feb	DOCWC133W13SE1296	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- MISCELLANEOUS	$174,582
22-Feb	DOCWE133R17SE0341	Not Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$78,372
22-Feb	DOCYA132314NC0038	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$95,000
22-Feb	DOCYA132317SE0046	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$74,505
23-Feb	DOC15366	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$608,134
23-Feb	DOC17068	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$134,570
23-Feb	DOC17123	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$905,169
23-Feb	DOC17125	Full & Open	SUPPORT- MANAGEMENT: OTHER	$81,044
23-Feb	DOC45PAPT1700121	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$56,312
23-Feb	DOC45PAPT1700127	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$639,415
23-Feb	DOC45PAPT1700129	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$85,871
23-Feb	DOC56PAPT1750025	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$1,490,925
23-Feb	DOCAB133014CN0007	Not Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$617,178
23-Feb	DOCAB133F16CQ0036T0002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$787,934
23-Feb	DOCEA133M17NC0216	Full & Open	SWITCHES	$53,216
23-Feb	DOCSB134113SE0289	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$348,303
23-Feb	DOCSB134114SE0082	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$149,994
23-Feb	DOCSB134116SE0147	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$95,985
23-Feb	DOCT0003	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$513,390
23-Feb	DOCT0010	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: INSPECTION (NON-CONSTRUCTION)	$54,772
23-Feb	DOCT0022	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$80,000
23-Feb	DOCT0027	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$86,903
23-Feb	DOCT0028	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$2,036,402
23-Feb	DOCWC133R13CN0036	Not Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$54,699
23-Feb	DOCWC133W15CN0052	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRIC WIRE AND POWER DISTRIBUTION EQUIPMENT	$194,628
23-Feb	DOCYA132113CN0009	Not Full & Open	SUPPORT- PROFESSIONAL: OTHER	$117,533
23-Feb	DOCYA132317NC0018	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$300,000
23-Feb	DOCYB132317NC0057	Full & Open	TRANSPORT/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUIT: PURCH OF TRANSIT/PUBLIC TRANSPOI	$91,408
24-Feb	DOC12902	Full & Open	IT AND TELECOM- SYSTEMS ANALYSIS	$574,648
24-Feb	DOC16465	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$67,410
24-Feb	DOC17120	Full & Open	IT AND TELECOM- PROGRAMMING	$91,258
24-Feb	DOC17122	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$73,733
24-Feb	DOC56PAPT1600543	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$58,976
24-Feb	DOCCO005	Full & Open	OFFICE FURNITURE	$100,000
24-Feb	DOCEA133W17SU0215	Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$93,797
24-Feb	DOCEG133W17SU0202	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$444,866
24-Feb	DOCSA130112CN0030	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS NETWORK MANAGEMENT	$405,535
24-Feb	DOCT0029	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$200,512
24-Feb	DOCWE133R17SE0360	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$59,292
24-Feb	DOCYA132313NC0105	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$2,427,403
24-Feb	DOCYA132316SE0074	Full & Open	SOCIAL- OTHER	$59,973
24-Feb	DOCYA132317NC0058	Full & Open	TEXTILE FABRICS	$196,740
26-Feb	DOC41PAPT1711062	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$70,669
26-Feb	DOC50PAPT1500062	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$955,964
26-Feb	DOC56PAPT1700361	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$202,868
26-Feb	DOCST133016NC0143	Full & Open	IT AND TELECOM- HELP DESK	$7,367,488
27-Feb	DOC44PAPT1611304	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$72,817
27-Feb	DOC45PAPT1700119	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$1,223,560
27-Feb	DOC50PAPT1600007	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$129,600
27-Feb	DOC56PAPT1500512	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,145,571
27-Feb	DOC56PAPT1600427	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,014,503
27-Feb	DOCEA133M17SE0362	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$118,090
27-Feb	DOCEA133M17SU0216	Not Full & Open	VIDEO RECORDING AND REPRODUCING EQUIPMENT	$154,438
27-Feb	DOCEA133W17SU0218	Full & Open	MISCELLANEOUS COMMUNICATION EQUIPMENT	$88,755
27-Feb	DOCEG133W17NC0226	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$209,212
27-Feb	DOCSB134117NC0132	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$50,402
27-Feb	DOCSB134117SU0146	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$54,975
27-Feb	DOCST133E13NC0330	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$193,869
27-Feb	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$179,167
27-Feb	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$279,167
28-Feb	DOC45PAPT1700138	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$925,455
28-Feb	DOC45PAPT1700149	Full & Open	IT AND TELECOM- FACILITY OPERATION AND MAINTENANCE	$1,181,867
28-Feb	DOC45PAPT1700150	Full & Open	IT AND TELECOM- FACILITY OPERATION AND MAINTENANCE	$4,427,368
28-Feb	DOC45PAPT1700151	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$536,407
28-Feb	DOC45PAPT1730007	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$269,611
28-Feb	DOC45PAPT1750007	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$472,732
28-Feb	DOC45PAPT1750008	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$202,269
28-Feb	DOC50PAPT1500022	Full & Open	SPECIAL STUDIES/ANALYSIS- OTHER	$600,000

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28-Feb	DOC50PAPT1720029	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$3,642,703
28-Feb	DOC56PAPT1600327	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$135,433
28-Feb	DOC56PAPT1600444	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$1,735,939
28-Feb	DOC56PAPT1600455	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$351,664
28-Feb	DOC56PAPT1700363	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$91,516
28-Feb	DOCAB133F13CQ00031121A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$91,944
28-Feb	DOCAB133F13CQ00032173B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$61,529
28-Feb	DOCAB133W13CN0016	Not Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$1,476,175
28-Feb	DOCC0018	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$174,724
28-Feb	DOCC0019	Full & Open	SUPPORT- MANAGEMENT: OTHER	$289,442
28-Feb	DOCEA133F17SE0366	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$91,383
28-Feb	DOCEA133W12CN0050	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$2,239,595
28-Feb	DOCEA133W17NC0229	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$88,791
28-Feb	DOCSB134117AE0024	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$77,770
28-Feb	DOCSB134117NC0143	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$75,794
28-Feb	DOCSB134117SU0145	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$176,046
28-Feb	DOCST133016NC1161	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$880,663
28-Feb	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$187,500
28-Feb	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$192,500
28-Feb	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$179,167
28-Feb	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$199,167
28-Feb	DOCT0004	Not Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: ENVIRONMENTAL SCIENCES (BASIC RESEARCH)	$220,586
28-Feb	DOCWC133R17SU0219	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$50,480
28-Feb	DOCWO003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$250,000
28-Feb	DOCYA132316NC0038	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$386,360
28-Feb	DOCYA132317NC0059	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$466,391
28-Feb	DOCYA132317NC0060	Full & Open	IT AND TELECOM- HELP DESK	$1,200,000
1-Mar	DOC001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$99,000
1-Mar	DOC009	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$266,514
1-Mar	DOC0234	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$107,558
1-Mar	DOC17109	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$350,039
1-Mar	DOC17126	Full & Open	IT AND TELECOM- PROGRAMMING	$927,367
1-Mar	DOC17127	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$120,000
1-Mar	DOC17129	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$550,535
1-Mar	DOC44PAPT1009008	Full & Open	IT AND TELECOM- FACILITY OPERATION AND MAINTENANCE	$78,038
1-Mar	DOC56PAPT1700358	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$3,400,000
1-Mar	DOC56PAPT1700359	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$4,611,650
1-Mar	DOCAB133M16CQ0008D0008	Full & Open	FUEL OILS	$113,412
1-Mar	DOCC0004	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$80,830
1-Mar	DOCSB134116CN0031	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$52,223
1-Mar	DOCSB134216SE0287	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$78,613
1-Mar	DOCSS130117CC0011	Full & Open	SUPPORT- MANAGEMENT: OTHER	$88,633
1-Mar	DOCT0001	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$84,750
1-Mar	DOCT0006	Not Full & Open	OTHER ENVIRONMENTAL SERVICES	$462,342
1-Mar	DOCWC133W15CN0046	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRIC WIRE AND POWER DISTRIBUTION EQUIPMENT	$66,014
1-Mar	DOCYA132314NC0128	Full & Open	SUPPORT- MANAGEMENT: OTHER	$749,216
2-Mar	DOC0246	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$72,874
2-Mar	DOC16419	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,930
2-Mar	DOC46PAPT1600427	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$51,174
2-Mar	DOCAB133F15CQ00120009B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$89,239
2-Mar	DOCAB133F15CQ00140019B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$106,000
2-Mar	DOCEA133F15CN0097	Not Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$100,685
2-Mar	DOCEA133M17SU0221	Not Full & Open	OFFICE FURNITURE	$681,249
2-Mar	DOCEA133W15BA0022C0001	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$245,700
2-Mar	DOCEG133W17NC0220	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$608,086
2-Mar	DOCEG133W17NC0241	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$56,647
2-Mar	DOCSB134116NC0123	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$116,813
2-Mar	DOCSB134117NC0152	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$813,831
2-Mar	DOCSB134217NC0135	Not Full & Open	UTILITIES- OTHER	$71,000
2-Mar	DOCSB135117SU0157	Not Full & Open	OFFICE FURNITURE	$60,743
2-Mar	DOCT0017	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$945,572
2-Mar	DOCYA132314NC0214	Full & Open	SUPPORT- MANAGEMENT: OTHER	$785,000
2-Mar	DOCYA132316CN0030	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$371,268
2-Mar	DOCYA132317NC0062	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$51,091
2-Mar	DOCYA132317NC0063	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,100,000
3-Mar	DOC0237	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$178,123
3-Mar	DOC0238	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$67,762
3-Mar	DOC0242	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$128,068
3-Mar	DOC0243	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$55,256
3-Mar	DOC0244	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$114,276
3-Mar	DOC17130	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$145,664
3-Mar	DOC17131	Full & Open	SUPPORT- MANAGEMENT: OTHER	$74,992
3-Mar	DOC56PAPT1750022	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,599,731
3-Mar	DOCCO2	Full & Open	SUPPORT- MANAGEMENT: OTHER	$106,408
3-Mar	DOCEA133C14NC1384	Full & Open	OTHER ENVIRONMENTAL SERVICES	$782,549
3-Mar	DOCRA133W17SU0212	Not Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$76,816
3-Mar	DOCT0007	Not Full & Open	ENVIRONMENTAL SYSTEMS PROTECTION- OIL SPILL RESPONSE	$51,360

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
3-Mar	DOCT0008	Not Full & Open	ENVIRONMENTAL SYSTEMS PROTECTION- OIL SPILL RESPONSE	$999,960
3-Mar	DOCYA132316NC0011	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$770,000
6-Mar	DOC0001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$129,572
6-Mar	DOC45PAPT1700147	Full & Open	IT AND TELECOM- IT STRATEGY AND ARCHITECTURE	$1,061,094
6-Mar	DOC45PAPT1700148	Full & Open	IT AND TELECOM- IT STRATEGY AND ARCHITECTURE	$1,016,730
6-Mar	DOC56PAPT1600408	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$636,704
6-Mar	DOC56PAPT1600410	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$736,319
6-Mar	DOC56PAPT1700311	Not Full & Open	SUPPORT- PROFESSIONAL: OTHER	$199,849
6-Mar	DOC56PAPT1700364	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$199,634
6-Mar	DOCDG133E10CQ0033T0006	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: ENGINEERING (BASIC RESEARCH)	$133,144
6-Mar	DOCEA133M17NC0249	Full & Open	SWITCHES	$75,233
6-Mar	DOCEG133W17SE0385	Not Full & Open	IT AND TELECOM- HELP DESK	$1,921,680
6-Mar	DOCRA133M17NC0250	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUITMENT: LODGING, HOTEL/MOTEL	$66,843
6-Mar	DOCSB134117SU0148	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$54,000
6-Mar	DOCSP133E17NC0183	Full & Open	MISCELLANEOUS CONSTRUCTION EQUIPMENT	$134,505
6-Mar	DOCT0044	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$103,516
6-Mar	DOCWO002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$530,000
6-Mar	DOCYA132314NC0217	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$182,471
6-Mar	DOCYA132317NC0065	Full & Open	HARDWARE, COMMERCIAL	$50,373
6-Mar	DOCYA132317NC0066	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$154,895
7-Mar	DOC001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$154,000
7-Mar	DOC16426	Full & Open	SUPPORT- MANAGEMENT: OTHER	$110,000
7-Mar	DOC17132	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$239,090
7-Mar	DOC50PAPT1600013	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$331,739
7-Mar	DOCAB133F13CQ00031086A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$140,200
7-Mar	DOCAB133F13CQ00031094A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$82,228
7-Mar	DOCC0006	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: ENVIRONMENTAL SCIENCES (BASIC RESEARCH)	$165,339
7-Mar	DOCC0078	Full & Open	EDUCATION/TRAINING- OTHER	$80,878
7-Mar	DOCEA133M17SE0100	Full & Open	DIESEL ENGINES AND COMPONENTS	$52,882
7-Mar	DOCEA133W17NC0209	Full & Open	SPECIAL STUDIES/ANALYSIS- SCIENTIFIC DATA	$498,000
7-Mar	DOCEG133C16NC1277	Full & Open	SUPPORT- MANAGEMENT: OTHER	$717,917
7-Mar	DOCRA133W15CC0035	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$60,000
7-Mar	DOCSA130116BU0003	Full & Open	SUPPORT- ADMINISTRATIVE: MAILING/DISTRIBUTION	$57,919
7-Mar	DOCT0006	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,475,000
7-Mar	DOCYA132313NC0216	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$60,000
7-Mar	DOCYA132315NC0006	Full & Open	SUPPORT- MANAGEMENT: OTHER	$85,000
7-Mar	DOCYA132317NC0067	Full & Open	SUPPORT- MANAGEMENT: OTHER	$2,663,806
8-Mar	DOC56PAPT1600399	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,462,242
8-Mar	DOCAB133E16CN0024	Not Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$636,295
8-Mar	DOCAB133F15CQ0031T0007	Full & Open	SUPPORT- MANAGEMENT: OTHER	$83,672
8-Mar	DOCAB133M10BU0037C0012	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$291,000
8-Mar	DOCC0005	Full & Open	SUPPORT- PROFESSIONAL: LEGAL	$157,300
8-Mar	DOCC0020	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$91,416
8-Mar	DOCEA133C16NC0296	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$57,500
8-Mar	DOCEA133M17SE0413	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUITMENT: LODGING, HOTEL/MOTEL	$115,785
8-Mar	DOCEA133W16NC0217	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$100,802
8-Mar	DOCSB133517NC0169	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$180,155
8-Mar	DOCSB134113SU0828	Full & Open	CHEMICALS	$72,960
8-Mar	DOCSB134115NC0093	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$903,091
8-Mar	DOCSB134115SU0323	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$97,100
8-Mar	DOCST133017CN0034	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRANSPORTATION: OTHER	$325,968
8-Mar	DOCYA132315NC0138	Full & Open	SUPPORT- MANAGEMENT: OTHER	$65,981
8-Mar	DOCYA132317NC0069	Full & Open	SUPPORT- PROFESSIONAL: REAL ESTATE BROKERAGE	$68,400
9-Mar	DOC0004	Full & Open	SUPPORT- MANAGEMENT: OTHER	$348,711
9-Mar	DOC0241	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$75,987
9-Mar	DOC0250	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$149,144
9-Mar	DOC16600	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$143,837
9-Mar	DOC17135	Full & Open	R&D- GENERAL SCI/TECH: MATHEMATICAL/COMPUTER SCIENCES (APPLIED RESEARCH/EXPLORATORY D	$92,861
9-Mar	DOC44PAPT1102145	Full & Open	SUPPORT- MANAGEMENT: OTHER	$322,781
9-Mar	DOC50PAPT1720031	Not Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$124,049
9-Mar	DOCDG133E10CQ0031T0007	Full & Open	OTHER ENVIRONMENTAL SERVICES	$1,400,715
9-Mar	DOCDG133E12CQ0020T0002	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$68,796
9-Mar	DOCEA133C17SE0425	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$95,136
9-Mar	DOCSB134116AE0033	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$55,000
9-Mar	DOCST133015CT0020	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$660,587
9-Mar	DOCST133017NC0236	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$130,807
9-Mar	DOCYA132114CN0014	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$108,000
9-Mar	DOCYA132315NC0027	Full & Open	EDUCATION/TRAINING- OTHER	$250,000
9-Mar	DOCYA132317AE0011	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$115,717
9-Mar	DOCYA132317NC0085	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$93,529
10-Mar	DOC45PAPT1700166	Full & Open	IT AND TELECOM- FACILITY OPERATION AND MAINTENANCE	$8,745,795
10-Mar	DOC45PAPT1700167	Full & Open	SUPPORT- ADMINISTRATIVE: COURT REPORTING	$50,000
10-Mar	DOC45PAPT1700169	Full & Open	IT AND TELECOM- FACILITY OPERATION AND MAINTENANCE	$3,536,013
10-Mar	DOC45PAPT1700170	Full & Open	SUPPORT- ADMINISTRATIVE: COURT REPORTING	$50,000
10-Mar	DOC56PAPT1600451	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$983,155
10-Mar	DOC56PAPT1600453	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$411,448
10-Mar	DOCBG133M17NC0257	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$125,812

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
10-Mar	DOCC0004	Full & Open	OTHER ENVIRONMENTAL SERVICES	$171,284
10-Mar	DOCEG133W16CC0008	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$134,209
10-Mar	DOCRA133014CN0023	Not Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRANSPORTATION: OTHER	$786,800
10-Mar	DOCT0001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$165,000
10-Mar	DOCYA132314NC0112	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$241,000
10-Mar	DOCYA132315NC0264	Full & Open	SUPPORT- MANAGEMENT: OTHER	$350,000
13-Mar	DOC16600	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$16,182,970
13-Mar	DOCAB133F15SU0494	Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$213,100
13-Mar	DOCCO004	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$500,000
13-Mar	DOCGF133E17NC0268	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$65,786
13-Mar	DOCGS07F0279MYB132311NC0485	Full & Open	HOUSEKEEPING- GUARD	$65,000
13-Mar	DOCSB132517CC0011	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$150,000
13-Mar	DOCSB134116SE0132	Full & Open	SUPPORT- MANAGEMENT: OTHER	$57,500
13-Mar	DOCSB135117NC0173	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$50,403
13-Mar	DOCST133016NC0468	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$100,173
13-Mar	DOCST133017NC0261	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$54,498
13-Mar	DOCWE133F17SU0259	Not Full & Open	PHOTOGRAPHIC EQUIPMENT AND ACCESSORIES	$61,850
13-Mar	DOCYB132317NC0071	Full & Open	HOUSEKEEPING- GUARD	$250,000
14-Mar	DOCBG133W17NC0269	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$134,225
14-Mar	DOCC0002	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$309,754
14-Mar	DOCDG133W10CQ0050T0024	Full & Open	IT AND TELECOM- CYBER SECURITY AND DATA BACKUP	$339,742
14-Mar	DOCEA133W15NC0350	Full & Open	IT AND TELECOM- CYBER SECURITY AND DATA BACKUP	$2,097,323
14-Mar	DOCRA133R17SE0338	Not Full & Open	OTHER ENVIRONMENTAL SERVICES	$148,000
14-Mar	DOCSB134117SU0167	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$407,000
14-Mar	DOCYA132314NC0205	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$915,000
14-Mar	DOCYA132317NC0073	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$1,342,814
15-Mar	DOC0001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$88,898
15-Mar	DOC15098	Full & Open	SUPPORT- MANAGEMENT: OTHER	$259,104
15-Mar	DOC46PAPT1750027	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$114,262
15-Mar	DOC56PAPT1600462	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,332,959
15-Mar	DOC56PAPT1750028	Not Full & Open	SUPPORT- PROFESSIONAL: OTHER	$1,088,989
15-Mar	DOCDG133W10CQ0026T0029	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$197,660
15-Mar	DOCDG133W12CQ0008T0002	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$124,888
15-Mar	DOCEA133F16NC0223	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$542,691
15-Mar	DOCEA133W16SE0511	Not Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$138,809
15-Mar	DOCSB134117SU0162	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$137,435
15-Mar	DOCWC133W15CN0107	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$214,536
15-Mar	DOCYB132316NC0305	Full & Open	OFFICE DEVICES AND ACCESSORIES	$60,000
15-Mar	DOCYB132317NC0074	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$100,000
16-Mar	DOC16448	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$59,979
16-Mar	DOC17134	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$67,292
16-Mar	DOC56PAPT1750007	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$365,467
16-Mar	DOCAB133C12CQ0039T0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$175,000
16-Mar	DOCAB133E16CN0127	Not Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$78,238
16-Mar	DOCAB133M13NC0264	Full & Open	HOUSEKEEPING- GUARD	$211,190
16-Mar	DOCAB133M16BA0086C0002	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$404,819
16-Mar	DOCC0003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$99,900
16-Mar	DOCDG1133W10CQ0050T0026	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$65,500
16-Mar	DOCDG133C12CQ0017T0001	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$50,000
16-Mar	DOCDG133E10CQ0033T0011	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$76,000
16-Mar	DOCDG133E12CQ0021T0006	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$1,597,150
16-Mar	DOCEA133F13SE1227	Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$80,400
16-Mar	DOCEA133M17SU0269	Full & Open	MISCELLANEOUS AIRCRAFT ACCESSORIES AND COMPONENTS	$64,000
16-Mar	DOCRA133R17BA0026C0004	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$85,556
16-Mar	DOCSB134117NC0163	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$85,646
16-Mar	DOCSB134117SU0168	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$50,300
16-Mar	DOCYA132114CN0016	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$196,704
16-Mar	DOCYA132314NC0090	Full & Open	SUPPORT- MANAGEMENT: OTHER	$246,160
17-Mar	DOC0005	Full & Open	SUPPORT- MANAGEMENT: OTHER	$400,000
17-Mar	DOC36127	Full & Open	HARDWARE, COMMERCIAL	$79,590
17-Mar	DOC40PAPT1705026	Not Full & Open	SUPPORT- PROFESSIONAL: LEGAL	$153,500
17-Mar	DOC45PAPT1600251	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$1,199,740
17-Mar	DOCAB133E16NC0264	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$355,358
17-Mar	DOCBG133W17NC0285	Full & Open	INFORMATION TECHNOLOGY EQUIPMENT SYSTEM CONFIGURATION	$298,554
17-Mar	DOCDG133W10CQ0049T0023	Full & Open	IT AND TELECOM- PROGRAMMING	$690,130
17-Mar	DOCGF133F17NC0284	Full & Open	SWITCHES	$87,658
17-Mar	DOCSB134116CN0010	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$60,962
17-Mar	DOCT0018	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$147,174
17-Mar	DOCWO003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$736,000
20-Mar	DOC001	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$802,266
20-Mar	DOC001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$339,138
20-Mar	DOC002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$84,058
20-Mar	DOC002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$300,000
20-Mar	DOC17141	Full & Open	SUPPORT- MANAGEMENT: OTHER	$167,874
20-Mar	DOC44PAPT1511050	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$535,380
20-Mar	DOC50PAPT1600008	Not Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRANSPORTATION: OTHER	$393,371
20-Mar	DOC56PAPT1700360	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$94,941

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
20-Mar	DOCDG133W10CQ0042T0053	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$1,338,278
20-Mar	DOCEA133C13NC1314	Full & Open	SUPPORT- PROFESSIONAL: OPERATIONS RESEARCH/QUANTITATIVE ANALYSIS	$113,110
20-Mar	DOCEA133M17SE0445	Not Full & Open	MISCELLANEOUS AIRCRAFT ACCESSORIES AND COMPONENTS	$65,741
20-Mar	DOCEG133W17NC0290	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$69,048
20-Mar	DOCSA130116NC0057	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$76,032
20-Mar	DOCT0021	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$173,643
20-Mar	DOCT0036	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS NETWORK MANAGEMENT	$97,000
20-Mar	DOCWC133W15CN0099	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$113,172
21-Mar	DOC0254	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$123,867
21-Mar	DOC16096	Full & Open	R&D- GENERAL SCI/TECH: MATHEMATICAL/COMPUTER SCIENCES (APPLIED RESEARCH/EXPLORATORY D	$2,296,948
21-Mar	DOC17150	Full & Open	IT AND TELECOM- PROGRAMMING	$136,685
21-Mar	DOC45PAPT1600113	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$151,650
21-Mar	DOC50PAPT1500019	Not Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$1,153,407
21-Mar	DOC56PAPT1600442	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$1,977,633
21-Mar	DOC56PAPT1600495	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$312,198
21-Mar	DOCAB133012CQ0037T0026	Not Full & Open	RADAR EQUIPMENT, EXCEPT AIRBORNE	$66,206
21-Mar	DOCAB133F13CQ00031122A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$52,000
21-Mar	DOCC0024	Full & Open	OTHER ENVIRONMENTAL SERVICES	$680,000
21-Mar	DOCC0025	Full & Open	OTHER ENVIRONMENTAL SERVICES	$247,151
21-Mar	DOCEA133C17SE0457	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$101,726
21-Mar	DOCSA130115CT0021	Full & Open	HOUSEKEEPING- GUARD	$241,951
21-Mar	DOCSB134114CN0018	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$2,395,504
21-Mar	DOCT0007	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,478,610
21-Mar	DOCYA132313CN0011	Not Full & Open	EDUCATION/TRAINING- OTHER	$564,000
21-Mar	DOCYA132313CN0017	Not Full & Open	SUPPORT- PROFESSIONAL: OTHER	$201,450
21-Mar	DOCYA132314NC0038	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$795,006
22-Mar	DOC46PAPT1700349	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$50,257
22-Mar	DOC56PAPT1600452	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,767,600
22-Mar	DOC56PAPT1600463	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$3,474,983
22-Mar	DOC56PAPT1700372	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$297,174
22-Mar	DOCAB133F15CQ00140004E	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$98,269
22-Mar	DOCAB133F16CQ0036T0003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$105,000
22-Mar	DOCC0003	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$592,114
22-Mar	DOCC0013	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$100,660
22-Mar	DOCCO007	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,773,134
22-Mar	DOCRA133R15SE0788	Not Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$50,064
22-Mar	DOCRA133R17SU0294	Not Full & Open	GEOPHYSICAL INSTRUMENTS	$106,533
22-Mar	DOCSA130114NC0003	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$421,660
22-Mar	DOCSB134115SE0380	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$168,500
22-Mar	DOCSB134117SU0164	Full & Open	ELECTRICAL AND ELECTRONIC PROPERTIES MEASURING AND TESTING INSTRUMENTS	$68,535
22-Mar	DOCSS132317NC0076	Full & Open	SUPPORT- MANAGEMENT: OTHER	$287,754
22-Mar	DOCST133017CN0036	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$511,262
22-Mar	DOCST133017CQ0026T0001	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$237,366
22-Mar	DOCYA132316NC0027	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$8,535,000
22-Mar	DOCYA132316NC0106	Full & Open	SUPPORT- MANAGEMENT: ADVERTISING	$301,072
23-Mar	DOC0001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$800,000
23-Mar	DOC0002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,589,900
23-Mar	DOC009	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$1,664,650
23-Mar	DOC13407	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM EVALUATION/REVIEW/DEVELOPMENT	$125,100
23-Mar	DOC45PAPT1600184	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$2,807,585
23-Mar	DOCC0009	Full & Open	SUPPORT- MANAGEMENT: OTHER	$203,059
23 Mar	DOCC0021	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$51,048
23-Mar	DOCDG133W12CQ0010T0007	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$106,815
23-Mar	DOCEA133C15BA0009T0002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$54,000
23-Mar	DOCEA133W15BA0021C0002	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$407,206
23-Mar	DOCEA133W15BA0035C0008	Full & Open	SUPPORT- MANAGEMENT: OTHER	$102,216
23-Mar	DOCEG133C16NC0906	Full & Open	SWITCHES	$730,048
23-Mar	DOCSA130114NC0002	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$136,081
23-Mar	DOCSB134116SE0342	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$105,617
23-Mar	DOCSB134117SU0173	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$124,350
23-Mar	DOCSS135117CC0012	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$286,583
23-Mar	DOCST133015NC1015	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$95,736
23-Mar	DOCT0001	Not Full & Open	MAINTENANCE OF LABORATORIES AND CLINICS	$454,740
23-Mar	DOCT0005	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$565,230
23-Mar	DOCT0011	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,798,101
23-Mar	DOCT0060	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$789,638
23-Mar	DOCWC133R16CN0019	Not Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$563,750
23-Mar	DOCYA132317NC0079	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$50,709
24-Mar	DOCAB133W14CN0041	Not Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$61,493
24-Mar	DOCC0002	Full & Open	ARCHITECT AND ENGINEERING- CONSTRUCTION: GOVERNMENT-OWNED CONTRACTOR-OPERATED (GC	$241,908
24-Mar	DOCDG133C12CQ0017T0020	Full & Open	OTHER ENVIRONMENTAL SERVICES	$125,500
24-Mar	DOCDG133E09CN0094	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,956,745
24-Mar	DOCDG133E10CQ0033T0016	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$191,000
24-Mar	DOCRA133R16CN0124	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$69,483
24-Mar	DOCSA130116NC0013	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$641,180
24-Mar	DOCSB134114SU0559	Full & Open	CHEMICALS	$79,975
24-Mar	DOCSB134116CN0010	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$67,385

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
24-Mar	DOCSB135117NC0193	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$193,339
24-Mar	DOCSP133E17CN0029	Not Full & Open	MAPS, ATLASES, CHARTS, AND GLOBES	$1,200,000
24-Mar	DOCSS135017CC0013	Full & Open	SUPPORT- MANAGEMENT: ADVERTISING	$66,586
24-Mar	DOCST133016NC0143	Full & Open	IT AND TELECOM- HELP DESK	$535,385
24-Mar	DOCT0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$62,799
24-Mar	DOCT0005	Not Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: ENVIRONMENTAL SCIENCES (BASIC RESEARCH)	$281,000
24-Mar	DOCT0013	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$382,482
24-Mar	DOCWC133W17SE0478	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$112,210
24-Mar	DOCYA132316NC0098	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$200,000
25-Mar	DOC41PAPT1511147	Not Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$82,146
27-Mar	DOC16600	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$341,920
27-Mar	DOC17160	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$147,203
27-Mar	DOC56PAPT1600391	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$1,549,926
27-Mar	DOCAB133F16CN0137	Full & Open	SPECIAL SERVICE VESSELS	$277,100
27-Mar	DOCC0005	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$1,467,343
27-Mar	DOCCO010	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$466,733
27-Mar	DOCDG1133W10CQ0050T0026	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$66,000
27-Mar	DOCEG133C15CN0058	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$672,375
27-Mar	DOCSB134115SE0093	Full & Open	SUPPORT- MANAGEMENT: OTHER	$74,500
27-Mar	DOCSB134117SE0107	Full & Open	INSTALLATION OF EQUIPMENT- INSTRUMENTS AND LABORATORY EQUIPMENT	$598,289
27-Mar	DOCT0004	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$91,588
27-Mar	DOCWC133W14CN0141	Not Full & Open	SUPPORT- PROFESSIONAL: PHYSICAL SECURITY AND BADGING	$305,629
27-Mar	DOCYA132317AE0016	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$147,185
27-Mar	DOCYA132317NC0081	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$95,440
28-Mar	DOC17148	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$226,831
28-Mar	DOC17154	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$242,058
28-Mar	DOC17162	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$52,654
28-Mar	DOC17166	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$166,681
28-Mar	DOC40PAPT1705027	Not Full & Open	PLASTICS FABRICATED MATERIALS	$69,905
28-Mar	DOC44PAPT1600107	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$64,007
28-Mar	DOC56PAPT1500592	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,307,752
28-Mar	DOC56PAPT1600409	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$309,813
28-Mar	DOC56PAPT1600423	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,056,675
28-Mar	DOC56PAPT1700318	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$610,760
28-Mar	DOC56PAPT1700373	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$821,074
28-Mar	DOCC0002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$70,000
28-Mar	DOCC0002	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$748,101
28-Mar	DOCC0007	Full & Open	SUPPORT- MANAGEMENT: OTHER	$52,000
28-Mar	DOCDG133E12CQ0021T0005	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$780,000
28-Mar	DOCEA133C13CQ0029T0006	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$137,568
28-Mar	DOCEA133F16NC0323	Full & Open	SPECIAL STUDIES/ANALYSIS- SCIENTIFIC DATA	$1,401,814
28-Mar	DOCEA133F17SE0377	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$343,200
28-Mar	DOCRA133R16CQ0049T0002	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$225,000
28-Mar	DOCSB134117SU0176	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$67,040
28-Mar	DOCSB134117SU0194	Full & Open	MISCELLANEOUS SPECIAL INDUSTRY MACHINERY	$340,684
28-Mar	DOCSP133E17SE0499	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ADP EQUIPMENT/SOFTWARE/SUPPLIES/SUPPORT EQUIPMEI	$53,792
28-Mar	DOCST133014NC0394	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$64,943
28-Mar	DOCST133015NC0113	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$1,275,561
28-Mar	DOCT0016	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$84,709
28-Mar	DOCT0027	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$421,966
28-Mar	DOCYA132314NC0058	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$9,329,000
28-Mar	DOCYA132317NC0082	Full & Open	SUPPORT- MANAGEMENT: OTHER	$451,195
28-Mar	DOCYA132317SE0069	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$98,551
28-Mar	DOCYB132315CN0018	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$52,588
29-Mar	DOC003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$11,000,000
29-Mar	DOC17165	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- REFRIGERATION, AIR CONDITIONING, AND AIR CIRCULATING	$123,000
29-Mar	DOC50PAPT1300028	Not Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$116,322
29-Mar	DOC56PAPT1750031	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$634,563
29-Mar	DOCAB133F12CQ0040T0020	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$65,520
29-Mar	DOCAB133F13CN0105	Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$308,300
29-Mar	DOCAB133F13CQ00031093A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$141,970
29-Mar	DOCAB133F14CN0054	Full & Open	FISHING VESSELS	$237,473
29-Mar	DOCAB133F16CN0161	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$364,362
29-Mar	DOCDG133W12CQ0010T0017	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$204,533
29-Mar	DOCEA133C17NC0314	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$134,612
29-Mar	DOCEA133M17SE0505	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$62,699
29-Mar	DOCEA133M17SE0506	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- RELOCATION: TRAVEL AGENT	$58,128
29-Mar	DOCEA133R15NC0457	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$57,824
29-Mar	DOCRA133F17SU0320	Full & Open	MISCELLANEOUS ENGINES AND COMPONENTS	$76,080
29-Mar	DOCSB134116NC0729	Full & Open	SUPPORT- MANAGEMENT: ADVERTISING	$100,000
29-Mar	DOCSB134117SU0189	Full & Open	MISCELLANEOUS MATERIALS HANDLING EQUIPMENT	$69,964
29-Mar	DOCSB134216SE0109	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$556,059
29-Mar	DOCSB134217NC0180	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$349,318
29-Mar	DOCST133015NC1015	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$114,611
29-Mar	DOCST133016SE1070	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$169,327
29-Mar	DOCST133017CN0037	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,240,641
29-Mar	DOCT0003	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$502,576

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
29-Mar	DOCT0009	Not Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$600,000
29-Mar	DOCWC133W17SE0493	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- REFRIGERATION, AIR CONDITIONING, AND AIR CIRCULATING	$98,796
29-Mar	DOCYA132315NC0138	Full & Open	SUPPORT- MANAGEMENT: OTHER	$50,046
29-Mar	DOCYA132315NC0208	Full & Open	SUPPORT- MANAGEMENT: OTHER	$203,754
29-Mar	DOCYB132317CN0009	Not Full & Open	IT AND TELECOM- IT STRATEGY AND ARCHITECTURE	$3,669,000
29-Mar	DOCYB132317SE0071	Not Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$64,309
30-Mar	DOC0252	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$126,752
30-Mar	DOC0253	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$70,147
30-Mar	DOC16467	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$270,412
30-Mar	DOC46PAPT1600389	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$853,993
30-Mar	DOC50PAPT1500018	Not Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$17,055,900
30-Mar	DOC56PAPT1600327	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$188,597
30-Mar	DOC56PAPT1600397	Full & Open	IT AND TELECOM- IT STRATEGY AND ARCHITECTURE	$53,784
30-Mar	DOCAB133F13CQ00031121A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$137,637
30-Mar	DOCAB133F15CQ00140009E	Full & Open	OTHER ENVIRONMENTAL SERVICES	$85,000
30-Mar	DOCAB133F15CQ00140015B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$188,611
30-Mar	DOCC0003	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$163,720
30-Mar	DOCC0004	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$60,000
30-Mar	DOCEA133C12NC0998	Full & Open	NATURAL RESOURCES/CONSERVATION- OTHER	$936,170
30-Mar	DOCEA133W16SU0372	Not Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$97,500
30-Mar	DOCEA133W17NC0305	Full & Open	SUPPORT- MANAGEMENT: OTHER	$106,333
30-Mar	DOCRA133F17SU0324	Not Full & Open	MISCELLANEOUS COMMUNICATION EQUIPMENT	$59,697
30-Mar	DOCSB134115NC0327	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$51,420
30-Mar	DOCSB134116SE0177	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$104,100
30-Mar	DOCSB134215CN0025	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$90,900
30-Mar	DOCSS130117NC0015	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$113,943
30-Mar	DOCT0008	Not Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$463,143
30-Mar	DOCT0010	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$385,000
30-Mar	DOCWO001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$263,154
30-Mar	DOCYA132314NC0082	Full & Open	MEDICAL- GENERAL HEALTH CARE	$180,864
31-Mar	DOC17167	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$118,735
31-Mar	DOC46PAPT1600396	Full & Open	IT AND TELECOM- DATA CONVERSION	$68,507
31-Mar	DOC46PAPT1600503	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$1,121,166
31-Mar	DOC46PAPT1750030	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$72,433
31-Mar	DOC50PAPT1100030	Not Full & Open	LEASE-RENT OF OTHER WAREHOUSE BLDGS	$553,117
31-Mar	DOC50PAPT1600007	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$70,400
31-Mar	DOC56PAPT1750033	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$9,767,654
31-Mar	DOCDG133017NCQTR2	Full & Open	INFORMATION TECHNOLOGY EQUIPMENT SYSTEM CONFIGURATION	$260,331
31-Mar	DOCEA133F17NC0323	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$456,456
31-Mar	DOCEA133W13CN0055	Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$101,158
31-Mar	DOCSB134114CN0052	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$139,859
31-Mar	DOCSB134115SE0212	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$122,500
31-Mar	DOCSB134217CN0015	Not Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$179,904
31-Mar	DOCSB134217NC0204	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$83,828
31-Mar	DOCSB135116NC0169	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$3,191,114
31-Mar	DOCSB135116NC0171	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$3,278,800
31-Mar	DOCST133E14NC0282	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$2,922,729
31-Mar	DOCT0069	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$100,971
31-Mar	DOCTO001	Not Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRANSPORTATION: OTHER	$334,878
31-Mar	DOCTO002	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$60,947
31-Mar	DOCYA132311CN0020	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$84,706
31-Mar	DOCYA132314NC0112	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$4,685,000
31-Mar	DOCYA132316NC0218	Full & Open	SUPPORT- MANAGEMENT: OTHER	$174,590
31-Mar	DOCYA132317NC0083	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$850,000
31-Mar	DOCYA132317NC0084	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$59,839
3-Apr	DOC0005	Full & Open	SUPPORT- MANAGEMENT: OTHER	$616,466
3-Apr	DOC17149	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$153,330
3-Apr	DOC56PAPT1700374	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$120,326
3-Apr	DOC56PAPT1700375	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$210,479
3-Apr	DOCBG133W17NC0333	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$52,896
3-Apr	DOCDG133W10CQ0049T0018	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$139,983
3-Apr	DOCDG133W12CQ0008T0012	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$142,747
3-Apr	DOCEA133F16NC1332	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$98,410
3-Apr	DOCEA133W15BR0007T0005	Full & Open	SALVAGE- MARINE VESSELS	$59,500
3-Apr	DOCEG133C16NC0473	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$265,993
3-Apr	DOCSB134115SE0249	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$156,000
3-Apr	DOCSB134117SU0206	Full & Open	IRON AND STEEL SCRAP	$99,520
3-Apr	DOCT0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$99,983
3-Apr	DOCT0001	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$194,657
3-Apr	DOCT0006	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,132,558
3-Apr	DOCYA132317NC0086	Full & Open	SUPPORT- MANAGEMENT: OTHER	$132,245
4-Apr	DOC17145	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$1,650,650
4-Apr	DOC17174	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$214,673
4-Apr	DOC45PAPT1600256	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$81,040
4-Apr	DOCAB133F13CQ00031122A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$175,426
4-Apr	DOCAB133F15CQ00140001E	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$66,502
4-Apr	DOCAB133F15CQ0031T0013	Full & Open	SUPPORT- MANAGEMENT: OTHER	$102,700

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
4-Apr	DOCDG133E09CN0094	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$32,000,000
4-Apr	DOCEA133F16SE0633	Not Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$569,134
4-Apr	DOCEA133M17NC0341	Full & Open	ELECTRICAL HARDWARE AND SUPPLIES	$87,404
4-Apr	DOCRA133C17SE0523	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$99,800
4-Apr	DOCSB135117NC0210	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$65,884
4-Apr	DOCSS132117NC0088	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$636,867
4-Apr	DOCST133017SE0526	Not Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$99,642
4-Apr	DOCYA132117SE0075	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$74,870
4-Apr	DOCYA132315NC0126	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$992,160
4-Apr	DOCYB132317SE0029	Not Full & Open	UTILITIES- WATER	$50,000
5-Apr	DOC17140	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$128,122
5-Apr	DOCAB133E16NC1140	Full & Open	OFFICE FURNITURE	$61,015
5-Apr	DOCT0009	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- REFRIGERATION, AIR CONDITIONING, AND AIR CIRCULATING	$397,780
5-Apr	DOCT0013	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,092,505
5-Apr	DOCT0016	Full & Open	IT AND TELECOM- HELP DESK	$106,579
5-Apr	DOCT0022	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$2,517,880
5-Apr	DOCWC133W17SE0532	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$54,789
5-Apr	DOCYA132313NC0154	Full & Open	SUPPORT- ADMINISTRATIVE: TRANSLATION AND INTERPRETING	$99,000
5-Apr	DOCYA132314NC0038	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$140,000
5-Apr	DOCYA132315NC0006	Full & Open	SUPPORT- MANAGEMENT: OTHER	$557,381
5-Apr	DOCYA132316NC0098	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$185,590
5-Apr	DOCYA132316SE0006	Not Full & Open	LEASE OR RENTAL OF EQUIPMENT- GROUND EFFECT VEHICLES, MOTOR VEHICLES, TRAILERS, AND CYCL	$725,000
6-Apr	DOC0002	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$630,000
6-Apr	DOC002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$80,091
6-Apr	DOC0262	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$140,235
6-Apr	DOC40PAPT1511232	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$83,465
6-Apr	DOC50PAPT1200050	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$195,033
6-Apr	DOC56PAPT1750037	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$124,025
6-Apr	DOCAB133C13NC0210	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$69,541
6-Apr	DOCAB133F15CQ00120008B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$82,810
6-Apr	DOCDG133W10CQ0042T0066	Full & Open	IT AND TELECOM- HELP DESK	$145,000
6-Apr	DOCSB134117SE0124	Not Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$118,750
6-Apr	DOCSB134117SU0195	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$108,060
6-Apr	DOCSB135016NC0372	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$70,000
6-Apr	DOCT0001	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$221,892
6-Apr	DOCT0008	Not Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$365,000
6-Apr	DOCYA132314NC0214	Full & Open	SUPPORT- MANAGEMENT: OTHER	$917,000
6-Apr	DOCYA132316NC0280	Full & Open	SUPPORT- MANAGEMENT: OTHER	$648,000
7-Apr	DOC0257	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$127,366
7-Apr	DOC0260	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$118,072
7-Apr	DOC17172	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$52,950
7-Apr	DOC17177	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$161,227
7-Apr	DOC56PAPT1600444	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$727,836
7-Apr	DOCDG133W05CQ1067T0082	Full & Open	COMMUNICATIONS SECURITY EQUIPMENT AND COMPONENTS	$1,190,000
7-Apr	DOCDG133W12CQ0008T0003	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$511,840
7-Apr	DOCEA133C15BA0009T0004	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$400,000
7-Apr	DOCEG133W17NC0350	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$170,684
7-Apr	DOCT0047	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$54,000
10-Apr	DOC006	Full & Open	OFFICE SUPPLIES	$349,350
10-Apr	DOCEE133C16SE0357	Not Full & Open	OTHER ENVIRONMENTAL SERVICES	$50,000
10-Apr	DOCRA133R17SU0339	Not Full & Open	ELECTRICAL HARDWARE AND SUPPLIES	$76,750
10-Apr	DOCSB134117NC0177	Full & Open	LEASE OR RENTAL OF EQUIPMENT - INFORMATION TECHNOLOGY EQUIPMENT/SOFTWARE/SUPPLIES/S	$50,541
10-Apr	DOCSB134117NC0219	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$82,000
10-Apr	DOCSP133E17NC0277	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$68,559
10-Apr	DOCSS133017NC0002	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$66,999
10-Apr	DOCST133013NC1167	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, ANALOG)	$259,807
10-Apr	DOCYA132314NC0028	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,684,977
11-Apr	DOC001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$150,000
11-Apr	DOC45PAPT1700034	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$99,725
11-Apr	DOC46PAPT1600390	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$256,722
11-Apr	DOC46PAPT1700355	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$84,836
11-Apr	DOCAB133F13CQ00031123A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$202,134
11-Apr	DOCC002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$97,111
11-Apr	DOCC0045	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$166,001
11-Apr	DOCEA133F17SE0377	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$156,525
11-Apr	DOCEG133C17NC0366	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$95,018
11-Apr	DOCEG133C17SE0562	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$59,990
11-Apr	DOCSB134117NC0218	Full & Open	INFORMATION TECHNOLOGY INPUT/OUTPUT AND STORAGE DEVICES	$52,000
11-Apr	DOCSB134216CN0037	Not Full & Open	IT AND TELECOM- PROGRAMMING	$1,325,500
11-Apr	DOCSS134117CC0015	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$143,832
11-Apr	DOCT0016	Full & Open	SUPPORT- MANAGEMENT: OTHER	$2,110,054
11-Apr	DOCWE133F17NC0369	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$55,686
11-Apr	DOCWE133F17SU0343	Not Full & Open	PHOTOGRAPHIC EQUIPMENT AND ACCESSORIES	$116,000
11-Apr	DOCWO001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,435,725
11-Apr	DOCWO004	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,000,000
11-Apr	DOCYA132316CN0013	Full & Open	SUPPORT- MANAGEMENT: OTHER	$119,500
11-Apr	DOCYB132317SU0030	Not Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$109,628

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
12-Apr	DOC0268	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$163,637
12-Apr	DOC40PAPT1711089	Full & Open	OFFICE SUPPLIES	$72,419
12-Apr	DOC46PAPT1700333	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$6,499,995
12-Apr	DOC46PAPT1700334	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$4,002,488
12-Apr	DOC46PAPT1700335	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$1,861,296
12-Apr	DOC56PAPT1600420	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$185,938
12-Apr	DOC56PAPT1600431	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$66,290
12-Apr	DOCEA133C17SU0345	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$74,501
12-Apr	DOCEA133M17CN0017	Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$252,146
12-Apr	DOCEA133M17SE0566	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$104,300
12-Apr	DOCGF133E17NC0354	Full & Open	SWITCHES	$121,234
12-Apr	DOCRA133F17SU0347	Not Full & Open	NAVIGATIONAL INSTRUMENTS	$75,660
12-Apr	DOCRA133M17NC0250	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUITMENT: LODGING, HOTEL/MOTEL	$51,418
12-Apr	DOCSB135017NC0223	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$55,026
12-Apr	DOCST133017SE0567	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIP- FIRE FIGHTING/RESCUE/SAFETY EQUIP; ENVIRON PROTECT EQUIP/	$193,127
12-Apr	DOCYA132315NC0003	Full & Open	IT AND TELECOM- HELP DESK	$1,696,501
12-Apr	DOCYA132317CN0004	Not Full & Open	IT AND TELECOM- PROGRAMMING	$3,365,662
13-Apr	DOC0002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,180,000
13-Apr	DOC0261	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$159,744
13-Apr	DOC16415	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$67,736
13-Apr	DOC16426	Full & Open	SUPPORT- MANAGEMENT: OTHER	$53,346
13-Apr	DOC17182	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$350,000
13-Apr	DOC17184	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$131,096
13-Apr	DOC17187	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$373,444
13-Apr	DOC56PAPT1700378	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$85,000
13-Apr	DOC56PAPT1700379	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$56,119
13-Apr	DOCDG133W12CQ0010T0014	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$397,354
13-Apr	DOCDG133W12CQ0010T0025	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$74,956
13-Apr	DOCEA133M17CN0007	Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$225,551
13-Apr	DOCEA133W16BR0005T0002	Full & Open	SALVAGE- MARINE VESSELS	$2,669,000
13-Apr	DOCEA133W17SE0570	Full & Open	SUPPORT- MANAGEMENT: ADVERTISING	$126,577
13-Apr	DOCEG133W17NC0378	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$79,951
13-Apr	DOCSB133515NC0213	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$858,089
13-Apr	DOCSB133516NC0105	Full & Open	SUPPORT- MANAGEMENT: OTHER	$420,306
13-Apr	DOCSB133516NC0126	Full & Open	SUPPORT- MANAGEMENT: OTHER	$840,303
13-Apr	DOCT0006	Not Full & Open	OTHER ENVIRONMENTAL SERVICES	$149,950
13-Apr	DOCWE133F17SE0216	Full & Open	SPECIAL STUDIES/ANALYSIS- SCIENTIFIC DATA	$56,000
13-Apr	DOCWE133R17NC0377	Full & Open	OFFICE FURNITURE	$77,026
13-Apr	DOCWO003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$419,465
13-Apr	DOCYA132117NC0095	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$154,478
13-Apr	DOCYA132316NC0080	Full & Open	SUPPORT- ADMINISTRATIVE: TRANSLATION AND INTERPRETING	$1,344,800
13-Apr	DOCYA132317NC0018	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$500,000
13-Apr	DOCYA132317NC0063	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$385,000
14-Apr	DOC17188	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$94,000
14-Apr	DOC17190	Full & Open	MISCELLANEOUS SPECIAL INDUSTRY MACHINERY	$230,850
14-Apr	DOC17192	Full & Open	MISCELLANEOUS SPECIAL INDUSTRY MACHINERY	$92,720
14-Apr	DOC17193	Full & Open	MISCELLANEOUS SPECIAL INDUSTRY MACHINERY	$144,509
14-Apr	DOC56PAPT1700377	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$1,589,711
14-Apr	DOCEA133F13NC0796	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$955,623
14-Apr	DOCEA133F16NC1282	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$59,105
14-Apr	DOCEG133C17SE0572	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$188,120
14-Apr	DOCSB133516NC0126	Full & Open	SUPPORT- MANAGEMENT: OTHER	$160,000
14-Apr	DOCSB134117SU0200	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$500,317
14-Apr	DOCSB134117SU0215	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$206,950
14-Apr	DOCST133017CC0022	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$649,982
14-Apr	DOCYA132313NC0010	Full & Open	IT AND TELECOM- IT STRATEGY AND ARCHITECTURE	$70,000
14-Apr	DOCYA132317SE0081	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$218,515
17-Apr	DOC17191	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$568,486
17-Apr	DOC46PAPT1700352	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$1,159,238
17-Apr	DOC56PAPT1600465	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$908,050
17-Apr	DOCAB133F15CQ0031T0008	Full & Open	SUPPORT- MANAGEMENT: OTHER	$76,092
17-Apr	DOCDG133E10CQ0033T0015	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$379,000
17-Apr	DOCRA133M17SE0574	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$121,368
17-Apr	DOCRA133M17SE0582	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$132,646
17-Apr	DOCSS132317NC0097	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,143,580
17-Apr	DOCSS133017NC0003	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$1,401,372
17-Apr	DOCT0007	Not Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$597,322
18-Apr	DOC0003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$688,000
18-Apr	DOC17196	Full & Open	MISCELLANEOUS SPECIAL INDUSTRY MACHINERY	$144,509
18-Apr	DOC56PAPT1600438	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$129,464
18-Apr	DOCAB133E16NC1580	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$142,611
18-Apr	DOCC0006	Full & Open	SUPPORT- MANAGEMENT: OTHER	$120,760
18-Apr	DOCC0008	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$431,245
18-Apr	DOCC0004	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$380,000
18-Apr	DOCDG133W12CN0056	Full & Open	MAINTENANCE OF ELECTRONIC AND COMMUNICATIONS FACILITIES	$625,626
18-Apr	DOCT0030	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$57,025
18-Apr	DOCT0032	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$65,295

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
18-Apr	DOCT0037	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$304,264
18-Apr	DOCYA132113CN0019	Full & Open	IT AND TELECOM- DATA CONVERSION	$72,303
18-Apr	DOCYA132313NC0216	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$69,033
18-Apr	DOCYA132314NC0138	Full & Open	SUPPORT- MANAGEMENT: OTHER	$130,000
18-Apr	DOCYA132317NC0098	Full & Open	SUPPORT- MANAGEMENT: OTHER	$123,533
18-Apr	DOCYB132317SU0033	Not Full & Open	MISCELLANEOUS ELECTRICAL AND ELECTRONIC COMPONENTS	$79,277
19-Apr	DOC0256	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$56,041
19-Apr	DOC46PAPT1700005	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$355,041
19-Apr	DOC56PAPT1600454	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$72,917
19-Apr	DOC56PAPT1750038	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$276,162
19-Apr	DOCAB133F14CN0044	Full & Open	FISHING VESSELS	$267,300
19-Apr	DOCAB133M16CQ0008D0009	Full & Open	FUEL OILS	$128,752
19-Apr	DOCAB133M16CQ0008D0010	Full & Open	FUEL OILS	$77,147
19-Apr	DOCCO02	Full & Open	EDUCATION/TRAINING- OTHER	$282,145
19-Apr	DOCEA133C15BA0028D0006	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$137,413
19-Apr	DOCSB130413NC0141	Full & Open	SUPPORT- MANAGEMENT: AUDITING	$243,641
19-Apr	DOCSB134115SE0256	Full & Open	INSTALLATION OF EQUIPMENT- INSTRUMENTS AND LABORATORY EQUIPMENT	$144,764
19-Apr	DOCSB134117NC0217	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$73,009
19-Apr	DOCST133017CC0025	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$172,030
19-Apr	DOCST133017SU0346	Full & Open	OFFICE FURNITURE	$177,324
19-Apr	DOCT0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$168,027
19-Apr	DOCT0001	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$292,001
19-Apr	DOCT0003	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$125,000
19-Apr	DOCT0010	Full & Open	OTHER ENVIRONMENTAL SERVICES	$275,000
19-Apr	DOCT0024	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$691,738
19-Apr	DOCWE133F17SE0233	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$54,654
20-Apr	DG133C10BU0087014	Not Full & Open	SUPPORT- PROFESSIONAL: OTHER	$608,420
20-Apr	DOC17181	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$159,915
20-Apr	DOC17197	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$143,872
20-Apr	DOC56PAPT1750030	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$95,435
20-Apr	DOCAB133F15CQ00140005A	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$74,304
20-Apr	DOCC0004	Full & Open	SUPPORT- MANAGEMENT: OTHER	$83,000
20-Apr	DOCDG133W12CQ0010T0010	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$138,392
20-Apr	DOCDG133W13SE1513	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$184,314
20-Apr	DOCEA133F17NC0371	Full & Open	MISCELLANEOUS COMMUNICATION EQUIPMENT	$638,328
20-Apr	DOCEA133W16CN0018	Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$300,000
20-Apr	DOCEA133W16SU0372	Not Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$172,784
20-Apr	DOCSA130114NC0169	Full & Open	IT AND TELECOM- HELP DESK	$196,655
20-Apr	DOCT0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$499,928
20-Apr	DOCT0007	Not Full & Open	OTHER ENVIRONMENTAL SERVICES	$247,656
20-Apr	DOCT0027	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$1,324,719
20-Apr	DOCYA132314NC0038	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$1,000,000
20-Apr	DOCYA132317CN0011	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$297,217
21-Apr	DOC17176	Full & Open	WALLBOARD, BUILDING PAPER, AND THERMAL INSULATION MATERIALS	$69,993
21-Apr	DOCEE133E17NC0387	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$102,433
21-Apr	DOCGF133E17NC0397	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$92,756
21-Apr	DOCSB134116SE0069	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$51,500
21-Apr	DOCSB134117SE0134	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- MISCELLANEOUS	$53,562
21-Apr	DOCWC133R17SU0359	Full & Open	SPECIAL SERVICE VESSELS	$143,022
22-Apr	DOCSP133E17NC0398	Full & Open	SUPPORT- MANAGEMENT: OTHER	$205,163
24-Apr	DOC17194	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$82,833
24-Apr	DOC43PAPT1711092	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$63,635
24-Apr	DOCAB133F14CN0056	Full & Open	FISHING VESSELS	$161,500
24-Apr	DOCEA133F16BA0047C0006	Full & Open	SUPPORT- MANAGEMENT: OTHER	$173,440
24-Apr	DOCEA133M16NC0409	Full & Open	HOUSEKEEPING- GUARD	$73,140
24-Apr	DOCRA133C17NC0376	Full & Open	SPECIAL STUDIES/ANALYSIS- MATHEMATICAL/STATISTICAL	$309,000
24-Apr	DOCSB134115CN0020	Not Full & Open	HOUSEKEEPING- OTHER	$806,983
24-Apr	DOCSB134117NC0226	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$64,282
24-Apr	DOCSB134117SE0130	Full & Open	SUPPORT- MANAGEMENT: ADVERTISING	$55,000
24-Apr	DOCSP133E17NC0399	Full & Open	SUPPORT- MANAGEMENT: OTHER	$274,654
24-Apr	DOCT0003	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$426,069
24-Apr	DOCT0079	Full & Open	COMMUNICATIONS SECURITY EQUIPMENT AND COMPONENTS	$253,482
24-Apr	DOCWO001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$557,062
24-Apr	DOCYA132317NC0101	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$939,827
25-Apr	DOC0004	Full & Open	SUPPORT- MANAGEMENT: OTHER	$74,669
25-Apr	DOC003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$34,290,655
25-Apr	DOC17199	Full & Open	SPECIAL STUDIES/ANALYSIS- SCIENTIFIC DATA	$69,336
25-Apr	DOC43PAPT1711093	Not Full & Open	SUPPORT- PROFESSIONAL: LEGAL	$113,000
25-Apr	DOC46PAPT1600407	Full & Open	IT AND TELECOM- TELEPROCESSING, TIMESHARE, AND CLOUD COMPUTING	$199,770
25-Apr	DOCAB133C14NC0184	Full & Open	SUPPORT- MANAGEMENT: OTHER	$500,692
25-Apr	DOCAB133F13CQ00031123A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$65,668
25-Apr	DOCAB133F15CQ00140020B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$78,738
25-Apr	DOCAB133F16CQ0036T0003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$94,141
25-Apr	DOCC0002	Full & Open	SPECIAL STUDIES/ANALYSIS- SCIENTIFIC DATA	$445,692
25-Apr	DOCC0008	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$53,359
25-Apr	DOCDG133W10CQ0026T0031	Full & Open	IT AND TELECOM- PROGRAMMING	$692,381
25-Apr	DOCEA133M17SE0123	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRANSPORTATION: MOTOR FREIGHT	$326,970

>= $50K

Date Signed	PIID	Full & Open	PSC Description	Obligated $
25-Apr	DOCRA133W16CN0066	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$215,736
25-Apr	DOCSB134116CN0019	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- REFRIGERATION, AIR CONDITIONING, AND AIR CIRCULATING	$98,496
25-Apr	DOCSB134116SE0288	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$92,200
25-Apr	DOCSB135017NC0241	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$83,452
25-Apr	DOCST133015NC1364	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$265,780
25-Apr	DOCT0001	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$665,462
25-Apr	DOCT0002	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$1,336,559
25-Apr	DOCT0009	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$59,395
25-Apr	DOCT0018	Full & Open	OTHER ENVIRONMENTAL SERVICES	$91,924
25-Apr	DOCYA132117SE0087	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$54,000
25-Apr	DOCYA132317SE0089	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$101,406
26-Apr	DOC36314	Full & Open	HARDWARE, COMMERCIAL	$218,260
26-Apr	DOC56PAPT1600326	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$460,717
26-Apr	DOC56PAPT1600455	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$61,722
26-Apr	DOC56PAPT1750026	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$338,471
26-Apr	DOCAB133E16CN0059	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$1,607,076
26-Apr	DOCAB133F15SE1579	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$182,000
26-Apr	DOCDG133W12CQ0008T0013	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$366,788
26-Apr	DOCEA133M15CQ0039D0046	Not Full & Open	PRESSURE, TEMPERATURE, AND HUMIDITY MEASURING AND CONTROLLING INSTRUMENTS	$106,555
26-Apr	DOCEE133C17NC0405	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$84,231
26-Apr	DOCSB134114SE0135	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$402,755
26-Apr	DOCSB134117NC0231	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$103,400
26-Apr	DOCSP133E17CN0046	Not Full & Open	MISCELLANEOUS COMMUNICATION EQUIPMENT	$206,000
26-Apr	DOCST133017NC0403	Full & Open	WIRE AND CABLE, ELECTRICAL	$79,620
26-Apr	DOCT0003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$238,702
26-Apr	DOCT0020	Full & Open	IT AND TELECOM- HELP DESK	$417,600
26-Apr	DOCYA132315SE0138	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$86,500
27-Apr	DOC001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$122,000
27-Apr	DOC45PAPT1700202	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$82,866
27-Apr	DOC45PAPT1700203	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$166,667
27-Apr	DOC56PAPT1600456	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$119,179
27-Apr	DOC56PAPT1700389	Full & Open	INFORMATION TECHNOLOGY EQUIPMENT SYSTEM CONFIGURATION	$546,035
27-Apr	DOCAB133F15CQ00140015A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$120,614
27-Apr	DOCBG133R17CN0048	Not Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$336,000
27-Apr	DOCCO006	Full & Open	OFFICE FURNITURE	$68,122
27-Apr	DOCDG133E09CN0094	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,067,823
27-Apr	DOCDG133W05CQ1067T0022	Full & Open	IT AND TELECOM- PROGRAMMING	$1,606,686
27-Apr	DOCEA133M17CN0010	Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$295,574
27-Apr	DOCEA133W15NC0030	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$429,492
27-Apr	DOCFN130117CT0026	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$819,058
27-Apr	DOCSA130115SE0014	Not Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$57,400
27-Apr	DOCSB132517NC0254	Full & Open	EDUCATION/TRAINING- OTHER	$250,000
27-Apr	DOCSB135016NC0240	Full & Open	TELEPHONE AND TELEGRAPH EQUIPMENT	$107,900
27-Apr	DOCSG133015NC0698	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$847,366
27-Apr	DOCSS135017CC0009	Full & Open	LEASE OR RENTAL OF EQUIPMENT - INFORMATION TECHNOLOGY EQUIPMENT/SOFTWARE/SUPPLIES/S	$209,148
27-Apr	DOCT0003	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$55,992
27-Apr	DOCT0028	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$358,699
27-Apr	DOCT0034	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$330,444
27-Apr	DOCT0057	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$304,933
27-Apr	DOCT0069	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$73,786
27-Apr	DOCWC133W17SU0375	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$54,700
27-Apr	DOCYA132316CN0017	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$2,400,000
27-Apr	DOCYA132316NC0027	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$2,000,000
28-Apr	DOC17203	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$2,134,986
28-Apr	DOC17207	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$132,464
28-Apr	DOC45PAPT1700034	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$62,984
28-Apr	DOC45PAPT1700191	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$52,391
28-Apr	DOC50PAPT1400016	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$71,995
28-Apr	DOC56PAPT1600397	Full & Open	IT AND TELECOM- IT STRATEGY AND ARCHITECTURE	$162,712
28-Apr	DOC56PAPT1750039	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$5,152,259
28-Apr	DOCAB133F17CN0044	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUITMENT: PASSENGER MARINE CHA	$756,750
28-Apr	DOCAB133F17CN0045	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUITMENT: PASSENGER MARINE CHA	$603,000
28-Apr	DOCDG133W12CQ0010T0017	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$367,673
28-Apr	DOCEA133W15NC0438	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$978,565
28-Apr	DOCRA133W15CN0035	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$172,739
28-Apr	DOCSB133516NC0231	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$408,576
28-Apr	DOCSB134115SE0422	Not Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$330,605
28-Apr	DOCSB134116SE0153	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$55,200
28-Apr	DOCSB134117SU0255	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$125,000
28-Apr	DOCSB134217CN0016	Not Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$1,189,520
28-Apr	DOCT0014	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$863,698
28-Apr	DOCT0032	Full & Open	SUPPORT- MANAGEMENT: OTHER	$2,297,739
28-Apr	DOCTO012	Full & Open	SUPPORT- MANAGEMENT: OTHER	$129,191
28-Apr	DOCYA132316NC0280	Full & Open	SUPPORT- MANAGEMENT: OTHER	$160,000
28-Apr	DOCYA132317NC0103	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$477,925
30-Apr	DOCSP133E17NC0414	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$173,482
1-May	DOCAB133E17SU0392	Full & Open	SWITCHES	$141,700

>= $50K

Date Signed	PIID	Full & Open	PSC Description	Obligated $
1-May	DOCDG133W05CQ1067T0083	Full & Open	COMMUNICATIONS SECURITY EQUIPMENT AND COMPONENTS	$992,356
1-May	DOCEA133F13NC1230	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$181,550
1-May	DOCEA133M17SE0639	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- RELOCATION: TRAVEL AGENT	$90,074
1-May	DOCEA133W15SE1578	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$114,880
1-May	DOCST133014NC0413	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$65,689
1-May	DOCT0002	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$110,999
1-May	DOCT0008	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: ENVIRONMENTAL SCIENCES (BASIC RESEARCH)	$639,961
1-May	DOCWC133W17SE0631	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$59,700
1-May	DOCWE133F17SE0682	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$67,200
1-May	DOCYA132317NC0105	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$56,028
2-May	DOC17206	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$135,750
2-May	DOC40PAPT1711095	Full & Open	MISCELLANEOUS ALARM, SIGNAL, AND SECURITY DETECTION SYSTEMS	$149,838
2-May	DOC45PAPT1500384	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$342,571
2-May	DOC46PAPT1750032	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$15,872,477
2-May	DOCC0007	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$172,085
2-May	DOCEA133F17SE0593	Full & Open	HOUSEKEEPING- OTHER	$90,000
2-May	DOCSB134117NC0264	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$274,671
2-May	DOCSB134117SE0145	Full & Open	R&D- GENERAL SCI/TECH: MATHEMATICAL/COMPUTER SCIENCES (APPLIED RESEARCH/EXPLORATORY D	$100,880
2-May	DOCSB134117SU0248	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$66,000
2-May	DOCSS130117CC0009	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$792,551
2-May	DOCSS132117NC0104	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$50,698
2-May	DOCSS133016CC0002	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$500,000
2-May	DOCYA132314NC0038	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$175,585
2-May	DOCYB132312CN0030	Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$100,000
3-May	DOC16142	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$75,798
3-May	DOC17180	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$81,310
3-May	DOC17209	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$113,856
3-May	DOC45PAPT1700185	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$77,483
3-May	DOC45PAPT1700207	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$68,162
3-May	DOCAB133E16CN0070	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$2,241,821
3-May	DOCAB133F13CQ00032173B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$355,066
3-May	DOCAB133F15CQ00140009A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$106,066
3-May	DOCAB133F15CQ00140011B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$78,999
3-May	DOCAB133F15CQ00140019B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$52,217
3-May	DOCAB133F16CQ0017T0001	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$637,838
3-May	DOCC0004	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$223,700
3-May	DOCC0005	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$213,699
3-May	DOCRA133F17NC0412	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$50,165
3-May	DOCSB134114SU0962	Full & Open	HOUSEKEEPING- WASTE TREATMENT/STORAGE	$226,270
3-May	DOCSB134117NC0261	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$75,879
3-May	DOCSB134117SU0260	Full & Open	OFFICE FURNITURE	$120,555
3-May	DOCSB134217NC0269	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$368,510
3-May	DOCT0001	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$335,174
3-May	DOCT0013	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,681,045
3-May	DOCYA132317NC0106	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,308,811
4-May	DOC17202	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$117,154
4-May	DOCAB133012CN0117	Full & Open	OPERATION OF MISCELLANEOUS BUILDINGS	$98,000
4-May	DOCAB133E15NC1316	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,199,081
4-May	DOCAB133F15CQ00140001A	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$93,520
4-May	DOCAB133F17CQ0003D0001	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$210,100
4-May	DOCDG133W12CQ0010T0011	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$106,554
4-May	DOCEA133F12NC1690	Full & Open	OTHER ENVIRONMENTAL SERVICES	$113,508
4-May	DOCEA133F17NC0423	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$176,579
4-May	DOCEG133F16NC0521	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$163,128
4-May	DOCEG133W17NC0431	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$80,761
4-May	DOCRA133F17SE0654	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$54,000
4-May	DOCRA133W17CC0014	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$85,157
4-May	DOCT0003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,386,300
4-May	DOCT0006	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$977,000
4-May	DOCT0006	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$593,000
4-May	DOCT0012	Full & Open	SUPPORT- MANAGEMENT: OTHER	$308,634
4-May	DOCT0021	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$934,641
5-May	DOC0003	Full & Open	ANTENNAS, WAVEGUIDES, AND RELATED EQUIPMENT	$453,594
5-May	DOC0271	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$150,000
5-May	DOCAB133F15CQ00140011E	Full & Open	SUPPORT- MANAGEMENT: OTHER	$155,000
5-May	DOCSB134117SU0270	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$89,164
5-May	DOCSB134217NC0270	Full & Open	IT AND TELECOM- PROGRAMMING	$481,018
5-May	DOCST133017SE0660	Full & Open	DIESEL ENGINES AND COMPONENTS	$109,385
8-May	DOC0001	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$376,978
8-May	DOC0001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$673,127
8-May	DOC36499	Full & Open	HARDWARE, COMMERCIAL	$50,957
8-May	DOC50PAPT1200041	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$1,268,970
8-May	DOC56PAPT1750005	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$299,863
8-May	DOCAB133016NC0345	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,388,320
8-May	DOCAB133E16NC0163	Full & Open	EDUCATION/TRAINING- OTHER	$815,626
8-May	DOCAB133E16NC1580	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$247,572
8-May	DOCAB133F15CQ00120001B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$82,400

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
8-May	DOCEA133F16NC0476	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$85,898
8-May	DOCEA133F17SE0672	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$65,000
8-May	DOCEA133M17SE0663	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- RELOCATION: TRAVEL AGENT	$164,056
8-May	DOCEA133W15NC0422	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$1,265,000
8-May	DOCRA133W16NC0621	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$104,613
8-May	DOCRA133W17SU0405	Full & Open	ELECTRICAL HARDWARE AND SUPPLIES	$51,055
8-May	DOCYA132312NC0423	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$160,000
8-May	DOCYA132313NC0088	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$96,492
9-May	DOC17212	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$90,048
9-May	DOC44PAPT1611166	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$3,188,620
9-May	DOC45PAPT1700196	Not Full & Open	SUPPORT- PROFESSIONAL: OTHER	$2,236,424
9-May	DOC45PAPT1700197	Full & Open	EDUCATION/TRAINING- GENERAL	$92,684
9-May	DOC46PAPT1700006	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$2,538,220
9-May	DOC46PAPT1750037	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$274,098
9-May	DOC56PAPT1600479	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$350,562
9-May	DOCC0006	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$1,137,785
9-May	DOCEA133C13CQ0015T0001	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$1,865,493
9-May	DOCEA133M17SE0678	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUITMENT: LODGING, HOTEL/MOTEL	$148,680
9-May	DOCEA133M17SU0399	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$181,900
9-May	DOCEA133W15BA0022C0002	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$211,328
9-May	DOCRA133M17NC0444	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$137,936
9-May	DOCSA130114NC0003	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$421,660
9-May	DOCSA130116CN0007	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$67,970
9-May	DOCSB134115NC0645	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$259,245
9-May	DOCSB135116NC0364	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$242,164
9-May	DOCSP133E17NC0448	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$53,613
9-May	DOCSS130117SU0007	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$82,124
9-May	DOCST133016NC1161	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$181,954
9-May	DOCYA132316NC0280	Full & Open	SUPPORT- MANAGEMENT: OTHER	$400,000
10-May	DOC16600	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$6,460,194
10-May	DOC44PAPT1711001	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$96,634
10-May	DOC44PAPT1711090	Full & Open	OFFICE SUPPLIES	$276,091
10-May	DOC45PAPT1700145	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$149,708
10-May	DOC56PAPT1600420	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,045,306
10-May	DOC56PAPT1600431	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$729,194
10-May	DOC56PAPT1700387	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$60,671
10-May	DOC56PAPT1700390	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$218,967
10-May	DOCAB133F14CQ0018T0008	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$131,200
10-May	DOCAB133M17CQ0035T0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$1,164,195
10-May	DOCDG133W05CQ1067T0004	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$1,022,015
10-May	DOCDG133W05CQ1067T0018	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$195,329
10-May	DOCDG133W05CQ1067T0035	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$302,223
10-May	DOCDG133W05CQ1067T0055	Full & Open	COMMUNICATIONS SECURITY EQUIPMENT AND COMPONENTS	$57,376
10-May	DOCEA133C13CQ0028T0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$84,087
10-May	DOCEA133M17SE0641	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- RELOCATION: TRAVEL AGENT	$61,510
10-May	DOCSA130114NC0078	Full & Open	IT AND TELECOM- IT STRATEGY AND ARCHITECTURE	$166,842
10-May	DOCSB130416NC0451	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$490,810
10-May	DOCSB134217CN0018	Not Full & Open	IT AND TELECOM- PROGRAMMING	$780,637
10-May	DOCSB135017SE0149	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$78,450
10-May	DOCT0017	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$55,000
10-May	DOCYA132314NC0058	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$5,026,783
10-May	DOCYA132317NC0109	Full & Open	PHOTOGRAPHIC PROJECTION EQUIPMENT	$94,605
11-May	DOC16419	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$85,298
11-May	DOC17210	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$97,177
11-May	DOC45PAPT1700203	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$1,833,333
11-May	DOC46PAPT1700333	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$12,999,989
11-May	DOC46PAPT1700334	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$8,004,975
11-May	DOC46PAPT1700335	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$3,722,592
11-May	DOC50PAPT1600034	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$164,342
11-May	DOC50PAPT1720037	Not Full & Open	SUPPORT- PROFESSIONAL: LEGAL	$286,960
11-May	DOC56PAPT1600327	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$58,985
11-May	DOC56PAPT1600472	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$487,443
11-May	DOC56PAPT1700388	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,086,589
11-May	DOCAB133E16CQ0030T0001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,112,698
11-May	DOCAB133E16NC0370	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$521,053
11-May	DOCAB133F17CN0047	Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$836,000
11-May	DOCC002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$60,694
11-May	DOCDG133W14SE3010	Not Full & Open	HOUSEKEEPING- GUARD	$55,128
11-May	DOCEA133C13CQ0015T0001	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$1,865,493
11-May	DOCEA133F15SE0973	Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$230,000
11-May	DOCEA133M17SE0136	Not Full & Open	NAVIGATIONAL INSTRUMENTS	$90,458
11-May	DOCEA133W17CN0016	Full & Open	OTHER ENVIRONMENTAL SERVICES	$11,225,495
11-May	DOCEG133W17NC0436	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$52,106
11-May	DOCFN130117CT0025	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$1,696,036
11-May	DOCSB130417NC0294	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$197,507
11-May	DOCSB134117NC0285	Full & Open	IT AND TELECOM- DATA CENTERS AND STORAGE	$257,962
11-May	DOCSB135117NC0293	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$217,562

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
11-May	DOCSS130117CN0009	Full & Open	SUPPORT- MANAGEMENT: OTHER	$113,304
11-May	DOCST133017SE0683	Full & Open	GENERATORS AND GENERATOR SETS, ELECTRICAL	$109,385
11-May	DOCT0007	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$120,000
11-May	DOCT0012	Not Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$104,415
11-May	DOCYA132316SE0088	Full & Open	SOCIAL- OTHER	$70,000
12-May	DOC002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$250,000
12-May	DOC17211	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$65,318
12-May	DOC17213	Not Full & Open	TELEPHONE AND TELEGRAPH EQUIPMENT	$60,531
12-May	DOC45PAPT1700198	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$56,375
12-May	DOC45PAPT1700199	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$99,870
12-May	DOC45PAPT1700212	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$413,670
12-May	DOCBG133F17SE0693	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$57,625
12-May	DOCBG133M16NC0498	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$297,405
12-May	DOCDG1133W10CQ0050T0026	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$400,000
12-May	DOCEA133C15BA0009T0003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$221,000
12-May	DOCEG133C16NC0686	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$107,373
12-May	DOCRA133M17SE0680	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRANSPORTATION: OTHER	$72,745
12-May	DOCSA130113NC0018	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$57,717
12-May	DOCSA130116NC0058	Full & Open	SUPPORT- MANAGEMENT: OTHER	$89,779
12-May	DOCSB134117SU0267	Full & Open	ELECTRICAL AND ELECTRONIC PROPERTIES MEASURING AND TESTING INSTRUMENTS	$149,987
12-May	DOCSS130117CC0012	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$821,117
12-May	DOCT0013	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$514,000
12-May	DOCYB132317SE0005	Full & Open	TRANSPORT/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUIT: PURCH OF TRANSIT/PUBLIC TRANSPOI	$50,325
13-May	DOC45PAPT1700220	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$58,352
13-May	DOC46PAPT1600449	Full & Open	VIDEO RECORDING AND REPRODUCING EQUIPMENT	$108,000
13-May	DOC56PAPT1600429	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$537,722
13-May	DOC56PAPT1600438	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$1,351,034
13-May	DOC56PAPT1750033	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$7,033,010
15-May	DOC003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$51,059
15-May	DOC17214	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$118,379
15-May	DOC56PAPT1600326	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$684,815
15-May	DOC56PAPT1750030	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$565,396
15-May	DOC56PAPT1750038	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,761,615
15-May	DOCAB133015CN0055	Not Full & Open	EDUCATION/TRAINING- OTHER	$69,827
15-May	DOCCO003	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$339,975
15-May	DOCDG133W05CQ1067T0002	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$4,260,253
15-May	DOCDG133W05CQ1067T0023	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$61,525
15-May	DOCDG133W10CQ0050T0019	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$302,860
15-May	DOCEA133F17SU0431	Not Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$58,950
15-May	DOCEA133M17CN0011	Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$521,114
15-May	DOCRA133F17SU0418	Not Full & Open	NAVIGATIONAL INSTRUMENTS	$61,752
15-May	DOCSA130115CN0013	Not Full & Open	SUPPORT- ADMINISTRATIVE: MAILING/DISTRIBUTION	$321,114
15-May	DOCSA130115CN0016	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- CONSTRUCTION AND BUILDING MATERIALS	$169,375
15-May	DOCSB134115CN0052	Not Full & Open	HOUSEKEEPING- WASTE TREATMENT/STORAGE	$596,960
15-May	DOCSB134117SU0264	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$142,995
15-May	DOCSB134117SU0287	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$180,180
15-May	DOCSB135015NC0308	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- RELOCATION: TRAVEL AGENT	$334,880
15-May	DOCSB135016SE0339	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$99,819
15-May	DOCST133016NC0337	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$835,764
15-May	DOCT0005	Full & Open	SUPPORT- MANAGEMENT: OTHER	$422,159
15-May	DOCT0014	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$1,100,000
16-May	DOC001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$142,000
16-May	DOC17215	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$81,310
16-May	DOC50PAPT1200042	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$3,369,470
16-May	DOC56PAPT1750040	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,367,882
16-May	DOCDG133E13CN0147	Not Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: ENGINEERING (MANAGEMENT/SUPPORT)	$338,783
16-May	DOCEA133C16CC0011	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$1,052,012
16-May	DOCEA133F15CN0097	Not Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$1,002,857
16-May	DOCRA133F17SU0406	Not Full & Open	ANTENNAS, WAVEGUIDES, AND RELATED EQUIPMENT	$102,490
16-May	DOCSB134117NC0288	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$84,550
16-May	DOCSB134117SU0268	Full & Open	ELECTRICAL AND ELECTRONIC PROPERTIES MEASURING AND TESTING INSTRUMENTS	$345,590
16-May	DOCSB134117SU0274	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$69,253
16-May	DOCSB135015SE0189	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$183,033
16-May	DOCSB135017NC0292	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$719,799
16-May	DOCYA132316NC0027	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$1,275,000
16-May	DOCYB132317NC0071	Full & Open	HOUSEKEEPING- GUARD	$750,000
17-May	C0022	Full & Open	SUPPORT- MANAGEMENT: OTHER	$724,918
17-May	DOC002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$250,000
17-May	DOC024	Full & Open	HARDWARE, COMMERCIAL	$89,890
17-May	DOC14467	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$397,987
17-May	DOC17216	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$59,131
17-May	DOC45PAPT1700158	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$97,976
17-May	DOC46PAPT1750039	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$326,560
17-May	DOC56PAPT1600454	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$802,083
17-May	DOC56PAPT1600456	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$888,514
17-May	DOC56PAPT1750002	Not Full & Open	SUPPORT- PROFESSIONAL: OTHER	$281,887
17-May	DOCAB133F12CQ0040T0016	Full & Open	SUPPORT- MANAGEMENT: OTHER	$158,252

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
17-May	DOCDG133W10CQ0041T0019	Full & Open	IT AND TELECOM- CYBER SECURITY AND DATA BACKUP	$1,289,869
17-May	DOCEA133W17SU0441	Not Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$59,650
17-May	DOCRA133M17NC0460	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$109,896
17-May	DOCSA130115NC0101	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$104,069
17-May	DOCSA130116CT0014	Full & Open	SUPPORT- MANAGEMENT: OTHER	$122,880
17-May	DOCSB134113NC0693	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$76,568
17-May	DOCSB134116NC0390	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,455,145
17-May	DOCSB134117NC0306	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$117,969
17-May	DOCSB134117SU0284	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$200,000
17-May	DOCST133017NC0450	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$53,443
17-May	DOCT0064	Full & Open	SUPPORT- MANAGEMENT: OTHER	$70,000
17-May	DOCWC133R17CN0054	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$398,607
17-May	DOCWC133R17CN0057	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$399,818
17-May	DOCWC133R17CN0058	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$399,986
17-May	DOCWC133R17CN0060	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$399,979
17-May	DOCWC133R17CN0062	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$400,000
17-May	DOCWC133R17CN0063	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$399,910
17-May	DOCWC133R17CN0064	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$400,000
17-May	DOCWC133R17CN0065	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$400,000
17-May	DOCYA132314NC0196	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,532,655
18-May	DOC001	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$75,000
18-May	DOC001	Full & Open	MISCELLANEOUS COMMUNICATION EQUIPMENT	$220,000
18-May	DOC45PAPT1700144	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$173,309
18-May	DOC50PAPT1200041	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$3,429,725
18-May	DOC50PAPT1200043	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$2,417,350
18-May	DOCC0003	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$176,325
18-May	DOCC0014	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$85,363
18-May	DOCDG133C12CQ0017T0020	Full & Open	OTHER ENVIRONMENTAL SERVICES	$169,891
18-May	DOCDG133W12CQ0008T0022	Full & Open	SUPPORT- MANAGEMENT: OTHER	$159,302
18-May	DOCDG133W12CQ0010T0006	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$58,224
18-May	DOCEG133C17NC0484	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$56,623
18-May	DOCRA133W13CN0061	Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$161,337
18-May	DOCSA130115CN0003	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$108,011
18-May	DOCSA130115CT0020	Full & Open	HOUSEKEEPING- GUARD	$2,186,810
18-May	DOCSA130115CT0021	Full & Open	HOUSEKEEPING- GUARD	$2,033,167
18-May	DOCSB132517NC0318	Full & Open	SUPPORT- MANAGEMENT: OTHER	$524,734
18-May	DOCSB134117NC0275	Full & Open	INFORMATION TECHNOLOGY INPUT/OUTPUT AND STORAGE DEVICES	$84,732
18-May	DOCSS130117NC0017	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$50,114
18-May	DOCSS133016CC0002	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$2,469,460
18-May	DOCT0003	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$443,667
18-May	DOCT0003	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$638,374
18-May	DOCT0030	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,536,103
18-May	DOCT0052	Full & Open	SUPPORT- MANAGEMENT: OTHER	$79,641
18-May	DOCT0056	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$262,712
18-May	DOCWC133R17CN0053	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$399,409
18-May	DOCWC133R17CN0056	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$399,774
18-May	DOCWC133R17CN0061	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$400,000
18-May	DOCYA132316CN0017	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$1,119,382
19-May	DOC0276	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$69,879
19-May	DOC17217	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$204,337
19-May	DOC45PAPT1700227	Full & Open	MINI AND MICRO COMPUTER CONTROL DEVICES	$600,000
19-May	DOCAB133C12CQ0039T0031	Full & Open	OTHER ENVIRONMENTAL SERVICES	$90,000
19-May	DOCEA133F17NC0491	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUITMENT: LODGING, HOTEL/MOTEL	$78,480
19-May	DOCEE133C17SU0449	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$106,421
19-May	DOCEG133M17NC0488	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$149,708
19-May	DOCEG133W17NC0493	Full & Open	COMMUNICATIONS SECURITY EQUIPMENT AND COMPONENTS	$68,856
19-May	DOCSB134117SU0286	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$57,960
19-May	DOCSB134117SU0297	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$301,695
21-May	DOCSP133E17NC0498	Full & Open	SUPPORT- MANAGEMENT: ACCOUNTING	$1,000,000
22-May	DOC002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$676,032
22-May	DOC17205	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$64,167
22-May	DOC17220	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$247,665
22-May	DOC45PAPT1700204	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- OTHER: OTHER	$612,000
22-May	DOC45PAPT1700231	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$540,336
22-May	DOCC0006	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$160,000
22-May	DOCCO1	Full & Open	SUPPORT- MANAGEMENT: OTHER	$155,000
22-May	DOCEA133W13CN0065	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- COMMUNICATION, DETECTION, AND COHERENT RADIATION	$138,870
22-May	DOCEA133W15BA0022C0003	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$257,075
22-May	DOCEA133W15SU0511	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$93,666
22-May	DOCSB134117SE0155	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$122,460
22-May	DOCSB134117SE0159	Not Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$273,071
22-May	DOCSB134117SU0291	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$131,294
22-May	DOCSB134117SU0299	Not Full & Open	CHEMICALS	$100,650
22-May	DOCSB135015NC0259	Full & Open	SUPPORT- MANAGEMENT: ACCOUNTING	$455,161
22-May	DOCSS130117CC0010	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$990,483
22-May	DOCSS130117CC0013	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$103,440
22-May	DOCT0003	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$143,945

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
22-May	DOCYA132316NC0038	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$884,360
23-May	DOC41PAPT1402225	Full & Open	NEWSPAPERS AND PERIODICALS	$179,057
23-May	DOC41PAPT1611285	Full & Open	NEWSPAPERS AND PERIODICALS	$872,672
23-May	DOC45PAPT1600256	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$132,754
23-May	DOC45PAPT1700219	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$192,429
23-May	DOC45PAPT1700230	Full & Open	SUPPORT- PROFESSIONAL: COMMUNICATIONS	$57,539
23-May	DOC45PAPT1700233	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$105,521
23-May	DOC45PAPT1700235	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$106,014
23-May	DOC45PAPT1700237	Full & Open	PHOTOGRAPHIC PROJECTION EQUIPMENT	$64,511
23-May	DOC56PAPT1750041	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,557,474
23-May	DOC56PAPT1750043	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$2,396,793
23-May	DOCAB133F13CQ00032140B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$74,524
23-May	DOCAB133F15CQ0036T0002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$305,778
23-May	DOCEA133W14SU1223	Not Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$109,674
23-May	DOCEA133W15CN0042	Full & Open	SUPPORT- PROFESSIONAL: WEATHER REPORTING/OBSERVATION	$368,709
23-May	DOCEG133W16NC0371	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$319,730
23-May	DOCEG133W17CC0015	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$1,868,570
23-May	DOCGF133E17NC0505	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$67,238
23-May	DOCSA130116CT0014	Full & Open	SUPPORT- MANAGEMENT: OTHER	$119,808
23-May	DOCSB130417NC0329	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$174,912
23-May	DOCSB134117NC0310	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$100,473
23-May	DOCSB134117NC0319	Full & Open	HARDWARE, COMMERCIAL	$194,997
23-May	DOCSB134117NC0321	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$122,791
23-May	DOCSB134117NC0324	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ADP EQUIPMENT/SOFTWARE/SUPPLIES/SUPPORT EQUIPMEI	$56,040
23-May	DOCSB134117SU0305	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$126,592
23-May	DOCSB135016NC0269	Full & Open	IT AND TELECOM- CYBER SECURITY AND DATA BACKUP	$77,235
23-May	DOCSB135117NC0331	Full & Open	HARDWARE, COMMERCIAL	$58,600
23-May	DOCSP133E17NC0479	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$306,924
23-May	DOCSS130117CC0014	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$127,200
23-May	DOCSS135017CC0023	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$192,182
23-May	DOCSS135017CC0027	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$242,338
23-May	DOCST133016NC0438	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$777,545
23-May	DOCST133017SE0671	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$314,799
23-May	DOCWC133015NC0679	Full & Open	SUPPORT- PROFESSIONAL: PHYSICAL SECURITY AND BADGING	$81,248
23-May	DOCWC133016NC0462	Full & Open	SUPPORT- MANAGEMENT: OTHER	$500,889
23-May	DOCYA132317NC0114	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$104,000
24-May	DOC17219	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$1,823,215
24-May	DOC43PAPT1711109	Not Full & Open	SUPPORT- PROFESSIONAL: LEGAL	$220,000
24-May	DOC44PAPT1611221	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$232,180
24-May	DOC46PAPT1650046	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$53,344
24-May	DOC56PAPT1600465	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$9,849,689
24-May	DOCAB133017CN0069	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$295,978
24-May	DOCC0023	Full & Open	SUPPORT- MANAGEMENT: OTHER	$252,442
24-May	DOCDG133W12CQ0010T0019	Full & Open	SUPPORT- MANAGEMENT: OTHER	$62,491
24-May	DOCEA133F16SE1244	Not Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$132,450
24-May	DOCEA133F16SE1249	Not Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$101,250
24-May	DOCEG133W16NC0357	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$85,803
24-May	DOCEG133W17NC0516	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$59,968
24-May	DOCSA130113CN0024	Not Full & Open	ARCHITECT AND ENGINEERING- CONSTRUCTION: MAINTENANCE BUILDINGS	$177,084
24-May	DOCSA130114NC0002	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$136,080
24-May	DOCSA130116CN0011	Not Full & Open	HOUSEKEEPING- OTHER	$561,145
24-May	DOCSB134116SU0365	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$83,200
24-May	DOCSB134117SU0294	Not Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$240,464
24-May	DOCSB135017NC0326	Full & Open	LEASE OR RENTAL OF EQUIPMENT - INFORMATION TECHNOLOGY EQUIPMENT/SOFTWARE/SUPPLIES/S	$1,587,112
24-May	DOCSP133E17CN0050	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$422,940
24-May	DOCST133015NC1288	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$572,702
24-May	DOCT0018	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$647,219
24-May	DOCWC133R17CN0059	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$400,000
24-May	DOCWC133R17NC0501	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$60,266
24-May	DOCWC133W17SU0396	Full & Open	SWITCHES	$68,142
24-May	DOCYA132115NC0140	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$632,290
24-May	DOCYA132315NC0247	Full & Open	SUPPORT- MANAGEMENT: OTHER	$66,000
24-May	DOCYA132316NC0280	Full & Open	SUPPORT- MANAGEMENT: OTHER	$2,104,287
24-May	DOCYA132317CN0010	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$1,980,250
25-May	DOC40PAPT1705039	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$67,829
25-May	DOC45PAPT1500317	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$5,569,139
25-May	DOC45PAPT1600335	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$1,346,642
25-May	DOC45PAPT1700034	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$303,475
25-May	DOC50PAPT1600046	Not Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$157,069
25-May	DOC56PAPT1600455	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$645,279
25-May	DOC56PAPT1700359	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$4,611,650
25-May	DOCAB133M15BA0033C0003	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$76,829
25-May	DOCBG133R17NC0511	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$216,007
25-May	DOCCO005	Full & Open	OFFICE FURNITURE	$135,313
25-May	DOCCO007	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$2,514,879
25-May	DOCCO009	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$104,339
25-May	DOCDG133E12CQ0020T0008	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$1,228,707

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
25-May	DOCDG133W10CQ0040T0010	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: MATHEMATICAL/COMPUTER SCIENCES (MANAGEMENT/SUPP	$69,869
25-May	DOCEA133F16SE0813	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$100,000
25-May	DOCEA133F17SE0726	Full & Open	LEASE/RENTAL OF FAMILY HOUSING FACILITIES	$75,106
25-May	DOCEA133M17CN0070	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$147,660
25-May	DOCEA133M17SE0329	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$464,631
25-May	DOCEA133W15SU1073	Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$465,000
25-May	DOCSB134116SE0318	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$171,200
25-May	DOCSB134117AE0039	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$54,954
25-May	DOCSB134117NC0339	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$2,020,714
25-May	DOCST133017CN0072	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$473,858
25-May	DOCT0003	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$130,000
25-May	DOCT0011	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$757,598
25-May	DOCT0019	Full & Open	SPECIAL STUDIES/ANALYSIS- SCIENTIFIC DATA	$393,337
25-May	DOCT0020	Full & Open	OTHER ENVIRONMENTAL SERVICES	$89,924
25-May	DOCT0026	Full & Open	RADAR EQUIPMENT, EXCEPT AIRBORNE	$233,441
25-May	DOCWE133M17SE0734	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$69,842
25-May	DOCYA132316CN0017	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$1,300,000
25-May	DOCYA132317NC0116	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,250,000
25-May	DOCYA132317NC0117	Full & Open	OFFICE SUPPLIES	$108,315
26-May	DOC16143	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$169,558
26-May	DOC40PAPT1611127	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$450,828
26-May	DOC45PAPT1700191	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$316,086
26-May	DOC46PAPT1711111	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$90,596
26-May	DOCAB133E16NC0214	Full & Open	IT AND TELECOM- HELP DESK	$909,803
26-May	DOCC0001	Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$145,290
26-May	DOCC0022	Full & Open	OTHER ENVIRONMENTAL SERVICES	$69,353
26-May	DOCEA133W12CN0050	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$12,140,934
26-May	DOCSA130116CN0012	Not Full & Open	OFFICE FURNITURE	$265,635
26-May	DOCSB134116CN0010	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$265,302
26-May	DOCSB134117NC0342	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$71,324
30-May	DOC0008	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$205,894
30-May	DOC0270	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$60,496
30-May	DOC17225	Full & Open	ENVIRONMENTAL SYSTEMS PROTECTION- ENVIRONMENTAL REMEDIATION	$200,000
30-May	DOC43PAPT1711112	Not Full & Open	SUPPORT- PROFESSIONAL: LEGAL	$136,500
30-May	DOC50PAPT1705040	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$1,165,175
30-May	DOC56PAPT1600327	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$129,612
30-May	DOC56PAPT1700391	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$239,655
30-May	DOC56PAPT1750039	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$2,757,045
30-May	DOCAB133013CN0095	Not Full & Open	SUPPORT- ADMINISTRATIVE: MAILING/DISTRIBUTION	$252,858
30-May	DOCAB133F13CQ000321698	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$115,806
30-May	DOCAB133F15CQ001200038	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$66,534
30-May	DOCAB133F16CN0143	Not Full & Open	MISCELLANEOUS ELECTRICAL AND ELECTRONIC COMPONENTS	$56,808
30-May	DOCAB133M14NC0442	Full & Open	HOUSEKEEPING- GUARD	$165,681
30-May	DOCC0008	Full & Open	SUPPORT- MANAGEMENT: OTHER	$487,445
30-May	DOCEA133C13NC0690	Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$126,454
30-May	DOCEA133M17SE0727	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$59,880
30-May	DOCEA133M17SE0728	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$79,700
30-May	DOCOR005	Full & Open	SUPPORT- MANAGEMENT: ADVERTISING	$500,000
30-May	DOCSB134117NC0336	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$171,342
30-May	DOCSB134117SU0309	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$214,500
30-May	DOCSB135117NC0346	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$312,689
30-May	DOCSS130117CT0032	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$658,141
30-May	DOCST133017NC0518	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$2,563,344
30-May	DOCST133017NC0525	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$100,017
30-May	DOCT0002	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$410,266
30-May	DOCT0009	Not Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$88,350
30-May	DOCWC133M14CN0051	Not Full & Open	HOUSEKEEPING- GUARD	$303,816
30-May	DOCYA132317NC0063	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$180,000
31-May	DOC0277	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$51,283
31-May	DOC44PAPT1102145	Full & Open	SUPPORT- MANAGEMENT: OTHER	$145,163
31-May	DOC46PAPT1711113	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$54,436
31-May	DOC56PAPT1600480	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$778,863
31-May	DOC56PAPT1700377	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$7,923,555
31-May	DOC56PAPT1700378	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$425,100
31-May	DOC56PAPT1700379	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$280,681
31-May	DOC56PAPT1700380	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$68,544
31-May	DOC56PAPT1700381	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$81,005
31-May	DOC56PAPT1700382	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$70,030
31-May	DOC56PAPT1700383	Full & Open	SUPPORT- ADMINISTRATIVE: LIBRARY	$84,994
31-May	DOC56PAPT1700392	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$168,120
31-May	DOC56PAPT1700393	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$53,047
31-May	DOCC0001	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$1,264,727
31-May	DOCC0007	Full & Open	SUPPORT- MANAGEMENT: OTHER	$80,000
31-May	DOCC0010	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: ENVIRONMENTAL SCIENCES (BASIC RESEARCH)	$149,827
31-May	DOCD0011	Full & Open	FUEL OILS	$187,110
31-May	DOCEA133C17NC0540	Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$134,420
31-May	DOCEA133F16NC0519	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$561,383

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
31-May	DOCEA133W15BR0007T0006	Full & Open	SALVAGE- MARINE VESSELS	$119,880
31-May	DOCFN130117CT0033	Full & Open	MISCELLANEOUS ELECTRICAL AND ELECTRONIC COMPONENTS	$138,854
31-May	DOCSA130114NC0078	Full & Open	IT AND TELECOM- IT STRATEGY AND ARCHITECTURE	$286,684
31-May	DOCSA130115CN0005	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$893,540
31-May	DOCSB135016NC0325	Full & Open	COMMUNICATIONS SECURITY EQUIPMENT AND COMPONENTS	$65,170
31-May	DOCSP133E17NC0527	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$461,367
31-May	DOCST133015NC0402	Full & Open	SUPPORT- ADMINISTRATIVE: TRANSLATION AND INTERPRETING	$180,000
31-May	DOCST133017NC0538	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$168,569
31-May	DOCST133017SU0475	Full & Open	OFFICE FURNITURE	$78,867
31-May	DOCT0028	Full & Open	INFORMATION TECHNOLOGY SUPPORT EQUIPMENT	$3,410,430
31-May	DOCWC133015NC0679	Full & Open	SUPPORT- PROFESSIONAL: PHYSICAL SECURITY AND BADGING	$4,786,147
31-May	DOCYA132313NC0216	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$696,361
31-May	DOCYA132316NC0027	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$2,600,000
31-May	DOCYA132316NC0161	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$290,121
1-Jun	DOC001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$130,000
1-Jun	DOC004	Full & Open	SUPPORT- MANAGEMENT: OTHER	$564,000
1-Jun	DOC40PAPT1711117	Full & Open	OFFICE SUPPLIES	$724,087
1-Jun	DOC45PAPT1700240	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$118,233
1-Jun	DOC45PAPT1700245	Full & Open	SUPPORT- ADMINISTRATIVE: TRANSLATION AND INTERPRETING	$329,297
1-Jun	DOCAB133F16CN0117	Full & Open	SUPPORT- MANAGEMENT: OTHER	$85,410
1-Jun	DOCBG133R17NC0547	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$417,282
1-Jun	DOCC0002	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$121,516
1-Jun	DOCC0008	Full & Open	SUPPORT- MANAGEMENT: FINANCIAL	$152,114
1-Jun	DOCDG133E10CQ0033T0019	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$409,572
1-Jun	DOCEA133017SE0713	Full & Open	HOUSEKEEPING- CARPET LAYING/CLEANING	$72,407
1-Jun	DOCEA133W17NC0528	Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$68,881
1-Jun	DOCEA133W17SE0744	Not Full & Open	SPECIAL STUDIES/ANALYSIS- SCIENTIFIC DATA	$74,999
1-Jun	DOCFN130117CT0019	Full & Open	SUPPORT- MANAGEMENT: OTHER	$203,073
1-Jun	DOCSB133517NC0359	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$301,463
1-Jun	DOCSP133E17CN0066	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$1,771,128
1-Jun	DOCSP133E17NC0551	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$212,058
1-Jun	DOCSS130117CC0009	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$530,431
1-Jun	DOCSS130117NC0019	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$87,883
1-Jun	DOCT0004	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$536,055
1-Jun	DOCT0027	Full & Open	RADAR EQUIPMENT, EXCEPT AIRBORNE	$193,966
1-Jun	DOCWC133W15CQ0060T0004	Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUITMENT: LODGING, HOTEL/MOTEL	$406,863
1-Jun	DOCYA132316CN0017	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$10,141,565
2-Jun	DOC0003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$450,000
2-Jun	DOC0005	Not Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$878,290
2-Jun	DOCSA130113CN0023	Full & Open	MAINTENANCE OF OFFICE BUILDINGS	$242,352
2-Jun	DOCSA130115CN0006	Full & Open	HOUSEKEEPING- FOOD	$58,359
2-Jun	DOCSB135014NC0200	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$453,223
2-Jun	DOCT0004	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$230,000
2-Jun	DOCT0008	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$152,698
4-Jun	DOCT0015	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$80,237
5-Jun	DOCAB133F15CQ0031T0014	Full & Open	SUPPORT- MANAGEMENT: OTHER	$86,221
5-Jun	DOCAB133F16CQ0036T0001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$68,688
5-Jun	DOCSB134116SE0268	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$78,718
5-Jun	DOCSB134117NC0354	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$134,816
5-Jun	DOCT0007	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$55,387
5-Jun	DOCYA132313NC0216	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$150,000
6-Jun	DOC0001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$382,000
6-Jun	DOC0002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$250,000
6-Jun	DOC0004	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,156,883
6-Jun	DOC0007	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: ENVIRONMENTAL SCIENCES (BASIC RESEARCH)	$277,295
6-Jun	DOC17231	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$86,577
6-Jun	DOC17232	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$183,244
6-Jun	DOC45PAPT1700207	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$340,812
6-Jun	DOC50PAPT1400020	Not Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$153,000
6-Jun	DOCBG133W17NC0556	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$54,144
6-Jun	DOCC0001	Full & Open	SUPPORT- MANAGEMENT: ACCOUNTING	$132,593
6-Jun	DOCEG133C16NC0660	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$78,500
6-Jun	DOCEG133W17NC0544	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$877,442
6-Jun	DOCSB130417NC0332	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$92,914
6-Jun	DOCSB134117SU0314	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$171,762
6-Jun	DOCT0001	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$100,000
6-Jun	DOCT0014	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$112,206
6-Jun	DOCT0019	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$1,893,678
6-Jun	DOCT0023	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$253,194
6-Jun	DOCWO003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$97,298
6-Jun	DOCYA132314NC0112	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$229,779
6-Jun	DOCYB132316SE0164	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ELECTRICAL AND ELECTRONIC EQUIPMENT COMPONENTS	$68,000
7-Jun	DOC17229	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$131,171
7-Jun	DOC50PAPT1500030	Not Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$134,409
7-Jun	DOC56PAPT1700369	Not Full & Open	TRANSPORTATION/TRAVEL/RELOCATION- OTHER: OTHER	$2,900,000
7-Jun	DOCAB133F12CQ0040T0019	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$79,970
7-Jun	DOCC0002	Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$179,294

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
7-Jun	DOCC0004	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$1,356,755
7-Jun	DOCC0009	Full & Open	SPECIAL STUDIES/ANALYSIS- SCIENTIFIC DATA	$93,522
7-Jun	DOCC0014	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$2,222,615
7-Jun	DOCDG133E10CQ0033T0010	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$105,000
7-Jun	DOCRA133F17SU0471	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$57,448
7-Jun	DOCSB134117AE0046	Full & Open	IT AND TELECOM- ANNUAL HARDWARE MAINTENANCE SERVICE PLANS	$72,800
7-Jun	DOCSB134117CN0019	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$432,792
7-Jun	DOCSB134117NC0227	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$95,921
7-Jun	DOCSB134117NC0347	Full & Open	COMMUNICATIONS SECURITY EQUIPMENT AND COMPONENTS	$504,397
7-Jun	DOCSB134117SU0174	Not Full & Open	TRANSPORT/TRAVEL/RELOCATION- TRAVEL/LODGING/RECRUIT: PURCH OF TRANSIT/PUBLIC TRANSPO	$918,000
7-Jun	DOCSS130116CN0016	Not Full & Open	IT AND TELECOM- CYBER SECURITY AND DATA BACKUP	$71,856
7-Jun	DOCSS130117NC0020	Full & Open	SUPPORT- MANAGEMENT: OTHER	$597,400
7-Jun	DOCSS132317CN0012	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$300,000
7-Jun	DOCT0003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$55,167
7-Jun	DOCT0033	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$114,065
7-Jun	DOCWE133F17SU0492	Full & Open	SEWAGE TREATMENT EQUIPMENT	$149,910
7-Jun	DOCYA132315NC0027	Full & Open	EDUCATION/TRAINING- OTHER	$250,000
7-Jun	DOCYA132315NC0126	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$148,402
7-Jun	DOCYA132315NC0168	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$50,000
8-Jun	DOC17143	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$83,755
8-Jun	DOCAB133E16NC0264	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$253,688
8-Jun	DOCAB133F13CQ00031122A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$233,022
8-Jun	DOCAB133F13CQ00031123A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$78,700
8-Jun	DOCAB133F13CQ00032169B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$117,247
8-Jun	DOCEA133M17NC0564	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$75,000
8-Jun	DOCEA133M17NC0571	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIPS, SMALL CRAFT, PONTOONS, AND FLOATING DOCKS	$134,305
8-Jun	DOCEG133W16SE0796	Full & Open	SUPPORT- MANAGEMENT: OTHER	$972,213
8-Jun	DOCEG133W17NC0569	Full & Open	ELECTRICAL HARDWARE AND SUPPLIES	$74,265
8-Jun	DOCRA133C15CN0136	Full & Open	SUPPORT- MANAGEMENT: OTHER	$272,673
8-Jun	DOCSB134117NC0381	Full & Open	OFFICE INFORMATION SYSTEM EQUIPMENT	$208,854
8-Jun	DOCSB134117SU0324	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$57,991
8-Jun	DOCSB134117SU0332	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$719,847
8-Jun	DOCSB134213NC0289	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$93,016
8-Jun	DOCSB134214CN0004	Not Full & Open	IT AND TELECOM- HELP DESK	$171,763
8-Jun	DOCSP133E17SE0769	Not Full & Open	SUPPORT- MANAGEMENT: ADVERTISING	$100,000
8-Jun	DOCSS130117CC0015	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$111,257
8-Jun	DOCSS130117CC0016	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$281,653
8-Jun	DOCST133017NC0518	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$767,076
8-Jun	DOCST133017NC0567	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$137,932
8-Jun	DOCT0009	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,531,258
8-Jun	DOCT0012	Full & Open	SUPPORT- MANAGEMENT: OTHER	$474,446
8-Jun	DOCT0021	Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$190,040
8-Jun	DOCYA132314CN0013	Not Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$869,560
8-Jun	DOCYB132312CN0030	Full & Open	HOUSEKEEPING- CUSTODIAL JANITORIAL	$440,000
9-Jun	DOC45PAPT1700217	Full & Open	IT AND TELECOM- FACILITY OPERATION AND MAINTENANCE	$174,192
9-Jun	DOC56PAPT1750031	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$230,000
9-Jun	DOCAB133016CQ0037T0003	Not Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$1,897,151
9-Jun	DOCAB133F17CN0052	Full & Open	TRANSPORT VESSELS, PASSENGER AND TROOP	$982,801
9-Jun	DOCC0006	Full & Open	SUPPORT- MANAGEMENT: OTHER	$95,704
9-Jun	DOCDG133W10CQ0040T0012	Full & Open	SPECIAL STUDIES/ANALYSIS- SCIENTIFIC DATA	$140,000
9-Jun	DOCRA133R17SU0491	Not Full & Open	METEOROLOGICAL INSTRUMENTS AND APPARATUS	$150,000
9-Jun	DOCSB134117SE0162	Not Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$130,000
9-Jun	DOCSB135017NC0353	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$121,725
9-Jun	DOCT0004	Full & Open	R&D- NATURAL RESOURCE: MARINE AND OCEANOGRAPHIC (BASIC RESEARCH)	$4,428,099
9-Jun	DOCT0006	Not Full & Open	OTHER ENVIRONMENTAL SERVICES	$1,264,481
9-Jun	DOCT0008	Not Full & Open	ENVIRONMENTAL SYSTEMS PROTECTION- OIL SPILL RESPONSE	$136,571
12-Jun	DOC0002	Full & Open	SUPPORT- MANAGEMENT: OTHER	$917,500
12-Jun	DOC17241	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$636,480
12-Jun	DOC45PAPT1700104	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$394,050
12-Jun	DOC46PAPT1700333	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$34,699,995
12-Jun	DOC46PAPT1700335	Not Full & Open	MISCELLANEOUS PRINTED MATTER	$10,780,413
12-Jun	DOCAB133F13CQ00031087A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$222,239
12-Jun	DOCAB133F13CQ00031119A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$151,382
12-Jun	DOCAB133F15CQ00120010A	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$94,563
12-Jun	DOCBG133W17NC0583	Full & Open	TELEPHONE AND TELEGRAPH EQUIPMENT	$261,593
12-Jun	DOCC0004	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$150,000
12-Jun	DOCEE133E17SE0767	Not Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$66,059
12-Jun	DOCEG133C17NC0565	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$111,862
12-Jun	DOCEG133W17NC0581	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$70,219
12-Jun	DOCRA133R17SU0498	Not Full & Open	ELECTRICAL HARDWARE AND SUPPLIES	$64,686
12-Jun	DOCSB134116CN0035	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$224,961
12-Jun	DOCSB134117SE0160	Full & Open	ENVIRONMENTAL SYSTEMS PROTECTION- ENVIRONMENTAL REMEDIATION	$511,200
12-Jun	DOCSB134117SU0308	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$566,246
12-Jun	DOCSP133E17NC0580	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$89,865
12-Jun	DOCT0003	Full & Open	MISCELLANEOUS AIRCRAFT ACCESSORIES AND COMPONENTS	$79,209
12-Jun	DOCT0003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$119,801
12-Jun	DOCT0017	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$449,514

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
12-Jun	DOCWC133R17CN0074	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$112,323
12-Jun	DOCWC133R17CN0076	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,994
12-Jun	DOCWC133R17CN0077	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,951
12-Jun	DOCWC133R17CN0081	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,911
12-Jun	DOCWC133R17CN0082	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,977
12-Jun	DOCWO004	Full & Open	SUPPORT- MANAGEMENT: OTHER	$350,000
13-Jun	DOC001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$210,000
13-Jun	DOC0020A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$100,000
13-Jun	DOC17228	Full & Open	SALVAGE- DEMOLITION OF BUILDINGS	$92,119
13-Jun	DOC36680	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, HYBRID)	$150,257
13-Jun	DOC45PAPT1700254	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$191,599
13-Jun	DOC56PAPT1700349	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$617,835
13-Jun	DOCAB133F15CN0029	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$3,188,518
13-Jun	DOCAB133F16CQ0036T0007	Full & Open	SUPPORT- MANAGEMENT: OTHER	$52,679
13-Jun	DOCAB133M16CQ0008D0012	Full & Open	FUEL OILS	$65,975
13-Jun	DOCCO005	Full & Open	SUPPORT- MANAGEMENT: OTHER	$331,240
13-Jun	DOCEA133C17NC0590	Full & Open	PRINTING, DUPLICATING, AND BOOKBINDING EQUIPMENT	$60,212
13-Jun	DOCEA133F17SU0501	Full & Open	ELECTRICAL AND ELECTRONIC PROPERTIES MEASURING AND TESTING INSTRUMENTS	$58,670
13-Jun	DOCEA133W14NC0661	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS AND TRANSMISSION	$50,616
13-Jun	DOCEE133E17SE0768	Not Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$60,110
13-Jun	DOCRA133M17SE0782	Full & Open	HOUSEKEEPING- GUARD	$53,694
13-Jun	DOCRA133W14CN0087	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$124,109
13-Jun	DOCSB134117NC0384	Full & Open	INFORMATION TECHNOLOGY INPUT/OUTPUT AND STORAGE DEVICES	$358,004
13-Jun	DOCSB134117NC0389	Full & Open	COMMUNICATIONS SECURITY EQUIPMENT AND COMPONENTS	$63,039
13-Jun	DOCSB134117NC0390	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$84,817
13-Jun	DOCSP133E17SE0783	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$60,560
13-Jun	DOCST133017NC0588	Full & Open	MISCELLANEOUS ALARM, SIGNAL, AND SECURITY DETECTION SYSTEMS	$113,900
13-Jun	DOCT0004	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- AIRCRAFT AND AIRFRAME STRUCTURAL COMPONENTS	$537,285
13-Jun	DOCT0008	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: ENVIRONMENTAL SCIENCES (BASIC RESEARCH)	$2,370,472
13-Jun	DOCT0010	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$50,000
13-Jun	DOCT0032	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$63,810
13-Jun	DOCWC133R17CN0075	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,994
13-Jun	DOCWC133R17CN0078	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,737
13-Jun	DOCWC133R17CN0079	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,914
13-Jun	DOCWC133R17CN0086	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,171
13-Jun	DOCWC133R17CN0087	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$120,000
14-Jun	DOC45PAPT1700256	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$61,302
14-Jun	DOC56PAPT1600539	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$4,568,326
14-Jun	DOCAB133F13CQ00031121A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$67,170
14-Jun	DOCC0024	Full & Open	SUPPORT- ADMINISTRATIVE: OTHER	$101,140
14-Jun	DOCDG133W10CQ0026T0029	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$395,319
14-Jun	DOCDG133W12CQ0010T0021	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$143,726
14-Jun	DOCDG133W12CQ0010T0022	Full & Open	IT AND TELECOM- PROGRAMMING	$147,975
14-Jun	DOCEA133F15SE1252	Not Full & Open	COMMERCIAL FISHING EQUIPMENT	$121,176
14-Jun	DOCEA133W16NC0569	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$162,360
14-Jun	DOCFN130117CT0040	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$3,631,670
14-Jun	DOCRA133R15CN0051	Full & Open	BUOYS	$570,000
14-Jun	DOCSB134115NC0565	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$132,201
14-Jun	DOCSB134116NC0286	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$517,994
14-Jun	DOCSB134117NC0387	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$963,374
14-Jun	DOCSB134117SE0176	Full & Open	OTHER ENVIRONMENTAL SERVICES	$50,882
14-Jun	DOCSB134117SU0326	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$82,665
14-Jun	DOCSS133017CC0005	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$745,000
14-Jun	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$358,333
14-Jun	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$375,000
14-Jun	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$558,333
14-Jun	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$385,000
14-Jun	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$358,333
14-Jun	DOCT0001	Full & Open	OTHER ENVIRONMENTAL SERVICES	$398,333
14-Jun	DOCT0026	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$365,601
14-Jun	DOCWC133R17CN0080	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,283
14-Jun	DOCWC133R17CN0084	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$120,000
14-Jun	DOCWC133R17CN0085	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,851
14-Jun	DOCWC133R17CN0090	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,994
14-Jun	DOCWC133R17CN0092	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,996
14-Jun	DOCWE133F17SE0794	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$55,800
14-Jun	DOCYA132316NC0027	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$625,000
14-Jun	DOCYB132315NC0056	Not Full & Open	UTILITIES- ELECTRIC	$450,000
14-Jun	DOCYB132317NC0074	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$379,493
15-Jun	DOC56PAPT1750016	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$61,391
15-Jun	DOCAB133C14CQ0059T0054	Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: OTHER (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$50,859
15-Jun	DOCAB133F13CQ00031122A	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$280,322
15-Jun	DOCAB133F13CQ00032173B	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$110,355
15-Jun	DOCAB133F15CQ0012DOC0001C	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$140,184
15-Jun	DOCAB133F16CQ0036T0005	Full & Open	SUPPORT- MANAGEMENT: OTHER	$90,070
15-Jun	DOCC0005	Full & Open	SUPPORT- MANAGEMENT: OTHER	$163,000
15-Jun	DOCCO008	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$55,080

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Date Signed	PIID	Full & Open	PSC Description	Obligated $
15-Jun	DOCEA133W15SE1202	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$100,000
15-Jun	DOCRA133W16CN0098	Not Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$74,212
15-Jun	DOCSA130116CT0062	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$103,989
15-Jun	DOCSB134115NC0449	Full & Open	IT AND TELECOM- HELP DESK	$302,080
15-Jun	DOCSP133E17NC0606	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$354,195
15-Jun	DOCSS134117SE0184	Full & Open	IT AND TELECOM- WEB-BASED SUBSCRIPTION	$90,000
15-Jun	DOCST133017CT0031	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$264,566
15-Jun	DOCST133017SE0785	Not Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$146,500
15-Jun	DOCT0010	Full & Open	SUPPORT- MANAGEMENT: OTHER	$50,000
15-Jun	DOCT0057	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$1,216,811
15-Jun	DOCWC133R17CN0088	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$120,000
15-Jun	DOCWC133R17CN0091	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,672
15-Jun	DOCWC133R17CN0096	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,976
15-Jun	DOCYA132311CN0027	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- ADP EQUIPMENT/SOFTWARE/SUPPLIES/SUPPORT EQUIPMEI	$87,358
15-Jun	DOCYA132313NC0181	Full & Open	MEDICAL- GENERAL HEALTH CARE	$63,232
15-Jun	DOCYA132314NC0128	Full & Open	SUPPORT- MANAGEMENT: OTHER	$1,931,686
16-Jun	DOC003	Full & Open	SUPPORT- MANAGEMENT: OTHER	$561,645
16-Jun	DOC17203	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$718,413
16-Jun	DOC17246	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$63,000
16-Jun	DOCS6PAPT1600326	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$235,239
16-Jun	DOCAB133F15SE1579	Full & Open	NATURAL RESOURCES/CONSERVATION- FISHERIES RESOURCES MANAGEMENT	$122,000
16-Jun	DOCDG133E12CQ0020T0012	Full & Open	SUPPORT- MANAGEMENT: OTHER	$73,207
16-Jun	DOCSB134115NC0192	Full & Open	SUPPORT- MANAGEMENT: FINANCIAL	$223,188
16-Jun	DOCSB134116SE0261	Not Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$243,180
16-Jun	DOCSB135017SE0182	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$91,525
16-Jun	DOCSP133E17NC0613	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$377,167
16-Jun	DOCT0006	Not Full & Open	OTHER ENVIRONMENTAL SERVICES	$460,000
16-Jun	DOCT0006	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$234,622
16-Jun	DOCT0020	Full & Open	IT AND TELECOM- HELP DESK	$352,860
16-Jun	DOCT0022	Not Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$60,000
16-Jun	DOCT0031	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$334,637
16-Jun	DOCWE133F17NC0615	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$74,984
16-Jun	DOCYA132317NC0130	Full & Open	HARDWARE, COMMERCIAL	$204,894
19-Jun	DOC16337	Full & Open	CONSTRUCTION OF OTHER INDUSTRIAL BUILDINGS	$109,365
19-Jun	DOC17236	Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$643,169
19-Jun	DOCC0004	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$170,000
19-Jun	DOCDG133E10CN0229	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,700,000
19-Jun	DOCFN130117CC0018	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$199,873
19-Jun	DOCRA133W17CN0094	Not Full & Open	MISCELLANEOUS ELECTRICAL AND ELECTRONIC COMPONENTS	$250,970
19-Jun	DOCSB134116SE0216	Not Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- MISCELLANEOUS	$96,900
19-Jun	DOCSB134117NC0348	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$75,157
19-Jun	DOCSS133517CC0033	Full & Open	SUPPORT- MANAGEMENT: FINANCIAL	$52,507
19-Jun	DOCSS133517CC0034	Full & Open	SUPPORT- MANAGEMENT: FINANCIAL	$59,341
19-Jun	DOCSS134117CC0032	Full & Open	SUPPORT- MANAGEMENT: OTHER	$367,610
19-Jun	DOCT0009	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$50,000
20-Jun	DOC44PAPT1402317	Full & Open	LEASE/RENTAL OF OTHER RESIDENTIAL BUILDINGS	$65,875
20-Jun	DOC45PAPT1700071	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$50,540
20-Jun	DOC45PAPT1700185	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$103,940
20-Jun	DOC45PAPT1700250	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$66,121
20-Jun	DOC45PAPT1700255	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$126,904
20-Jun	DOC46PAPT1750041	Full & Open	MISCELLANEOUS OFFICE MACHINES	$329,079
20-Jun	DOCAB133F14CQ0041D0011	Not Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$50,755
20-Jun	DOCAB133F15CQ00120009A	Full & Open	SPECIAL STUDIES/ANALYSIS- ANIMAL/FISHERIES	$72,348
20-Jun	DOCAB133M17CQ0035T0001	Full & Open	MAINT/REPAIR/REBUILD OF EQUIPMENT- SHIP AND MARINE EQUIPMENT	$165,585
20-Jun	DOCBG133F17SE0805	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$107,500
20-Jun	DOCBG133R17NC0619	Full & Open	INFORMATION TECHNOLOGY COMPONENTS	$540,083
20-Jun	DOCDG133E10CQ0033T0011	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$124,729
20-Jun	DOCEA133M17SU0530	Not Full & Open	DIESEL ENGINES AND COMPONENTS	$605,902
20-Jun	DOCEA133W17SU0506	Not Full & Open	CHAIN AND WIRE ROPE	$137,330
20-Jun	DOCRA133R15CQ0044D0005	Full & Open	CHEMICALS	$451,000
20-Jun	DOCRA133W16NC0933	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$60,924
20-Jun	DOCSB134116NC0286	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$3,107,117
20-Jun	DOCSB134117NC0399	Full & Open	INFORMATION TECHNOLOGY CENTRAL PROCESSING UNIT (CPU, COMPUTER, DIGITAL)	$124,974
20-Jun	DOCSB134117SU0346	Full & Open	LABORATORY EQUIPMENT AND SUPPLIES	$481,150
20-Jun	DOCSB134216CN0008	Not Full & Open	IT AND TELECOM- PROGRAMMING	$568,477
20-Jun	DOCSB135017NC0292	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$307,984
21-Jun	DOC0002	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$950,000
21-Jun	DOC0275	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$168,232
21-Jun	DOC0281	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$55,137
21-Jun	DOC0288	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$269,604
21-Jun	DOC17249	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$102,253
21-Jun	DOC44PAPT1711110	Full & Open	SUPPORT- MANAGEMENT: ADVERTISING	$72,723
21-Jun	DOC45PAPT1600101	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$147,013
21-Jun	DOC45PAPT1700251	Full & Open	SUPPORT- PROFESSIONAL: OTHER	$108,112
21-Jun	DOCC0003	Full & Open	SUPPORT- MANAGEMENT: CONTRACT/PROCUREMENT/ACQUISITION SUPPORT	$108,000
21-Jun	DOCEA133C14NC1384	Full & Open	OTHER ENVIRONMENTAL SERVICES	$674,803
21-Jun	DOCFN130117CT0049	Full & Open	IT AND TELECOM- OTHER IT AND TELECOMMUNICATIONS	$116,438

OAM - DoC Contracts Over $50K.xlsx

>= $50K

Date Signed	PIID	Full & Open	PSC Description	Obligated $
21-Jun	DOCSA130112CN0030	Full & Open	IT AND TELECOM- TELECOMMUNICATIONS NETWORK MANAGEMENT	$561,704
21-Jun	DOCSA130114NC0083	Full & Open	SUPPORT- MANAGEMENT: FINANCIAL	$53,999
21-Jun	DOCSB134117SE0164	Full & Open	OTHER ENVIRONMENTAL SERVICES	$501,875
21-Jun	DOCSB134117SU0360	Not Full & Open	MISCELLANEOUS SPECIAL INDUSTRY MACHINERY	$208,250
21-Jun	DOCSB134216NC0713	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$79,946
21-Jun	DOCST133017CT0032	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$132,281
21-Jun	DOCT0004	Full & Open	SUPPORT- PROFESSIONAL: PROGRAM MANAGEMENT/SUPPORT	$1,140,000
21-Jun	DOCT0005	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$169,392
21-Jun	DOCT0029	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$161,180
21-Jun	DOCT0068	Full & Open	SUPPORT- MANAGEMENT: OTHER	$2,103,112
21-Jun	DOCWC133M16NC0037	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$70,000
21-Jun	DOCWC133R17CN0083	Full & Open	R&D- OTHER RESEARCH AND DEVELOPMENT (APPLIED RESEARCH/EXPLORATORY DEVELOPMENT)	$119,995
21-Jun	DOCYA132113CN0015	Not Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$263,720
21-Jun	DOCYA132315NC0234	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$138,466
21-Jun	DOCYA132316NC0187	Full & Open	SUPPORT- MANAGEMENT: OTHER	$365,596
22-Jun	DOC15366	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$817,684
22-Jun	DOC15461	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$600,381
22-Jun	DOC17245	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$86,671
22-Jun	DOC56PAPT1600376	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$53,865
22-Jun	DOC56PAPT1700372	Full & Open	SUPPORT- PROFESSIONAL: HUMAN RESOURCES	$62,928
22-Jun	DOCAB133F15CQ00130001D	Full & Open	PHOTO/MAP/PRINT/PUBLICATION- OTHER	$108,836
22-Jun	DOCC0004	Full & Open	SUPPORT- MANAGEMENT: OTHER	$175,463
22-Jun	DOCC0009	Full & Open	SUPPORT- MANAGEMENT: OTHER	$112,168
22-Jun	DOCC0040	Full & Open	OFFICE FURNITURE	$214,929
22-Jun	DOCRA133C17CC0030	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$65,000
22-Jun	DOCSB134117NC0406	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$76,692
22-Jun	DOCSB134117NC0420	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$114,597
22-Jun	DOCSB134117SE0098	Not Full & Open	MAINTENANCE OF MISCELLANEOUS BUILDINGS	$62,003
22-Jun	DOCST133017CN0037	Not Full & Open	SUPPORT- MANAGEMENT: OTHER	$56,000
22-Jun	DOCT0021	Full & Open	OTHER ENVIRONMENTAL SERVICES	$89,924
22-Jun	DOCT0028	Full & Open	OTHER ENVIRONMENTAL SERVICES	$67,430
22-Jun	DOCYA132317NC0134	Full & Open	HARDWARE, COMMERCIAL	$303,254
23-Jun	DOC001	Full & Open	SUPPORT- MANAGEMENT: OTHER	$2,950,000
23-Jun	DOC0274	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$50,694
23-Jun	DOC0283	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$121,912
23-Jun	DOC0284	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$149,589
23-Jun	DOC0286	Full & Open	SUPPORT- MANAGEMENT: LOGISTICS SUPPORT	$74,880
23-Jun	DOC44PAPT1711041	Full & Open	SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$433,962
23-Jun	DOC56PAPT1600555	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$252,637
23-Jun	DOCC0007	Full & Open	OTHER ENVIRONMENTAL SERVICES	$52,093
23-Jun	DOCSB135017NC0415	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$68,165
23-Jun	DOCSB135017SE0180	Full & Open	INFORMATION TECHNOLOGY SOFTWARE	$67,500
23-Jun	DOCT0003	Full & Open	R&D- NATURAL RESOURCE: MARINE AND OCEANOGRAPHIC (BASIC RESEARCH)	$3,753,059
23-Jun	DOCT0009	Not Full & Open	R&D- GENERAL SCIENCE/TECHNOLOGY: ENVIRONMENTAL SCIENCES (BASIC RESEARCH)	$474,810
23-Jun	DOCT0013	Full & Open	IT AND TELECOM- SYSTEMS DEVELOPMENT	$1,981,590
23-Jun	DOCWC133F14CQ0013T0004	Not Full & Open	ARCHITECT AND ENGINEERING- GENERAL: OTHER	$61,124
23-Jun	DOCYA132316SE0127	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$88,781
23-Jun	DOCYA132317NC0018	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$50,000
23-Jun	DOCYA132317NC0136	Full & Open	IT AND TELECOM- ANNUAL SOFTWARE MAINTENANCE SERVICE PLANS	$572,250
25-Jun	DOCSP133E17NC0622	Full & Open	IT AND TELECOM- INTEGRATED HARDWARE/SOFTWARE/SERVICES SOLUTIONS, PREDOMINANTLY SERV	$109,507
Grand Total				$1,376,691,500

6. How many contract employees now work in office space with civil service employees of the Commerce Department?

ANSWER:

The Department of Commerce has 24,400 contract employees and 30,592 civil service employees in locales where these two groups are reported to share office space across the continental United States and territories, not including the U.S. Patent and Trade Office (USPTO). USPTO does not have any offices in Alaska nor Hawaii. At the USPTO, 1,436 contract employees and 6,730 civil service employees work in office space nationwide.
Data Source: Security Manager Download (June 28, 2017)
Locales are defined as a city/state combination (i.e. Gaithersburg, MD)

7. Please provide a list of how many contract and civil service employees now work in each major location (i.e., locations with more than 100 total employees) staffed and maintained by the Commerce Department.

ANSWER:

In major locations (with more than 100 total civil service employees), the Department of Commerce has 18,797 and 23,91 civil service employees in locations across the continental United States and territories not including the U.S. Patent and Trade Office (USPTO).
A table showing counts of USPTO employees and contractors who work onsite in major locations (defined as locations with more than 100 total employees) is below.

PTO employees and contractors who work onsite in major locations (defined as locations with more than 100 total employees):

Location	Civil Service Employees	Contractors
Alexandria, VA	5,870	1,102
Arlington, VA	368	270
Dallas, TX	98	14

Note: USPTO has staff in three other locations (Detroit, MI; Denver, CO and San Jose, CA), however, the total count in each location is less than 100. Additionally, USPTO's workforce includes full-time teleworkers, who are not counted in these numbers.

ATTACHMENT. Contractors&Civil EmployeesbyMajorDutyLocation-Summary.pdf

8. In the Department's fiscal year 2018 budget request, there is an increase highlighted for the trade enforcement and compliance activities of the International Trade Administration (ITA). At the same time, however, the budget request completely eliminates Federal funding for the EDA Trade Adjustment Assistance centers that help companies harmed by overseas competition to develop strategies to recover jobs and income. Five of these centers are located in states in which President Trump was the top vote-getter in the 2016 presidential election. The Administration is also proposing huge cuts in U.S. and Foreign Commercial Service officers, who, in addition to working to expand U.S. exports, spend an average of 13 percent of their time on trade enforcement and monitoring activities. Why is the Administration simultaneously proposing to increase funding for one aspect of trade enforcement (ITA Enforcement and Compliance) while cutting other important components of trade enforcement and trade policy (EDA Trade Adjustment Assistance Centers and ITA Global Markets)? Aren't these latter budget proposals contrary to the desires of so many of President Trump's most enthusiastic 2016 election supporters, who expect effective Federal policies on trade enforcement, the reduction of U.S. trade deficits, and care and concern for Americans negatively impacted by trade? Why the inconsistency in fiscal year 2018 budget requests between ITA Enforcement and Compliance on the one hand, and EDA Trade Adjustment Assistance Centers and ITA Global Markets on the other?

ANSWER:

In the last 52 years, EDA has made significant investments in economically distressed regions, based on locally-driven strategies and needs, that have spurred local innovation and entrepreneurship, created and saved jobs and leveraged private investments.

That said, the Administration's 2018 Budget prioritizes rebuilding the military and making critical investments in the Nation's security. It also identifies the savings and efficiencies needed to keep the Nation on a responsible fiscal path. Many difficult decisions and tradeoffs were necessary to reach the funding level provided in this budget, and the elimination of EDA and its Trade Adjustment Assistance for Firms program is one of them. The President's budget aims to change the role and size of the Federal Government by prioritizing programs that serve the most critical functions and consolidating or eliminating duplicative or less critical programs.
The Administration's approach to economic development is to boost the entire economy through regulatory reform, unleashing energy resources, trade reform and tax cuts for businesses and individuals.

The President's Budget needed to make difficult choices among competing funding priorities, to expand resources to ensure job growth and the enforcement of laws promoting fair trade.
The budget for ITA strengthens trade law enforcement functions to ensure American businesses get fair opportunities in the global marketplace. Funding increases will help ITA build capacity to self-initiate antidumping duty (AD) and countervailing duty (CVD) investigations, as well as strengthen all AD and CVD investigations. While lower-priority activities are reduced, the Department will nevertheless continue to work to ensure the execution of a robust program of programs and activities that grow U.S. exports.

Department of Commerce[1]
List of Contract and Civil Service Employees in Major Locations

Duty Location	Contractor[2]	Employee	Grand Total
SUITLAND, MD	2,540	5,343	7,883
GAITHERSBURG, MD	2,202	2,956	5,158
WASHINGTON, DC	2,638	2,481	5,119
SILVER SPRING, MD	3,968	2,550	6,518
JEFFERSONVILLE, IN	517	1,512	2,029
BOULDER, CO	1,351	986	2,337
SEATTLE, WA	392	899	1,291
HONOLULU, HI	868	342	1,210
TUCSON, AZ	159	339	498
COLLEGE PARK, MD	206	297	503
MIAMI, FL	247	281	528
NEW YORK, NY	34	275	309
SAN DIEGO, CA	17	250	267
NORFOLK, VA	30	235	265
KANSAS CITY, MO	139	214	353
WOODS HOLE, MA	545	202	747
GLOUCESTER, MA	112	191	303
JUNEAU, AK	141	182	323
CHARLESTON, SC	320	184	504
NEW YORK-KINGS, NY	86	180	266
HAGERSTOWN, MD	209	179	388
ST PETERSBURG, FL	44	180	224
ATLANTA, GA	24	178	202
NORMAN, OK	363	175	538
PHILADELPHIA, PA	50	173	223
ANCHORAGE, AK	61	165	226
GERMANTOWN, MD	105	156	261
NEWPORT, OR	222	164	386
PORTLAND, OR	50	148	198
CHICAGO, IL	64	146	210
HOUSTON, TX	27	134	161
FORT WORTH, TX	22	131	153
ASHEVILLE, NC	201	130	331
NEW YORK -BRONX, NY	71	126	197
PASCAGOULA, MS	183	126	309
RESTON, VA	130	123	253
NEW YORK -QUEENS, NY	91	118	209
ALEXANDRIA, VA	198	111	309
LAKEWOOD, CO	9	109	118
SACRAMENTO, CA	63	109	172
LAS VEGAS, NV	7	105	112
SAN ANTONIO, TX	46	104	150
SALT LAKE CITY, UT	9	101	110
LOS ANGELES, CA	36	101	137
Total	**18,797**	**23,191**	**41,988**

1/ Does not include U.S. Patent and Trade Office employees

2/ Contractors may not work at a locale on a regular basis or routinely sit side-by-side in physical proximity to federal counterparts.

9. On the White House web site, a February 28, 2017 headline from the Office of the White House Press Secretary is entitled "President Trump is Working to Rebuild our Nation's Infrastructure." President Trump's budget request for fiscal year 2018, released in outline form just a few weeks later, seeks to completely eliminate funding for Economic Development Administration (EDA) programs and to rescind $47 million in prior-year funding for EDA programs. These programs, especially EDA Public Works, have successfully funded infrastructure improvements across the United States for decades. Yet the Trump Administration is seeking to eliminate these programs while simultaneously promoting a public message that "President Trump is Working to Rebuild our Nation's Infrastructure." Why the inconsistency? Why is the Department (and the wider Trump Administration, for that matter) involved in the sending of contradictory messages to the American public? During the formulation of the fiscal year 2018 budget request, did the Department alert the White House or the Office of Management and Budget to the reality that the EDA budget request for fiscal year 2018 contradicts earlier statements from the Trump White House?

ANSWER:

The Administration's 2018 Budget prioritizes rebuilding the military and making critical investments in the Nation's security. It also identifies the savings and efficiencies needed to keep the Nation on a responsible fiscal path.
Rebuilding America's infrastructure is a critical pillar of the President's agenda to promote job creation and grow the U.S. economy. Regulatory reforms will spur growth and investment by, for example, dramatically reducing permitting time for infrastructure projects from 10 years to 2 years and to get a "yes" or "no" quickly by streamlining regulations. The President's plan will unleash private sector capital and expertise to rebuild our cities and states. The FY 2018 Budget Request dedicates $200 billion for infrastructure that can be leveraged through public-private partnerships into a $1 trillion investment into our crumbling infrastructure systems. Investing in rural infrastructure is a key part of the President's plan.

10. President Trump is proposing both to end support for Economic Development Administration (EDA) grants and to rescind $47 million in EDA funds from prior years. This despite the fact that EDA has enjoyed broad bipartisan support since its creation in 1965. EDA makes targeted investments to help create and retain well-paying jobs in distressed communities. President Trump issued an executive order on April 25, 2017 that among other things, seeks to promote rural prosperity in America, including through the establishment of an Interagency Task Force on Agriculture and Rural Prosperity, of which the Secretary of Commerce is a member. Historically, roughly two-thirds of EDA's assistance has gone to rural areas in support of infrastructure improvements and job creation. Why the contradiction between President Trump's executive order and the Trump Administration's budget request for EDA? Does the Department agree that bringing jobs and private investment to distressed areas, not excluding rural areas, must be a major priority of the Federal Government? Why are the Trump Administration and its Commerce Department turning their backs on so many people—particularly in rural areas—by pushing to eliminate EDA? Since the Secretary of Commerce is a member of

the Task Force on Agriculture and Rural Prosperity, did the Secretary or other officials or staff of the Commerce Department, during final formulation of the fiscal year 2018 budget request, alert the White House or the Office of Management and Budget to the reality that the EDA budget request for fiscal year 2018 contradicts the intent of the April 25, 2017 Executive Order, which directs the Task Force to "identify legislative, regulatory, and policy changes to promote in rural America agriculture, economic development, job growth, infrastructure improvements, technological innovation, energy security, and quality of life.."?

ANSWER:

The Administration's approach to economic development is to boost the entire economy through regulatory reform, unleashing energy resources, addressing unfair trading practices and tax reform. It also includes rebuilding America's infrastructure, with rural infrastructure being a key part of the President's plan. Through its role as a member agency in the President's Interagency Task Force on Agriculture and Rural Prosperity, the Department of Commerce intends to ensure that infrastructure in rural communities, which includes the expansion of broadband access, remains a key priority.

11. Please describe the precise sources of the proposed $47 million in Economic Development Administration program rescissions. Are there any EDA programs that are expected to be disproportionately impacted by this rescission?

ANSWER:

The $47 million rescission proposed in the President's Budget for EDA assumed elimination of EDA in FY 2018. If the rescission is enacted at that level, EDA would likely use a combination of the unobligated balances brought forward from FY 2017, estimated to be $15 million, and recoveries realized in FY 2018, projected to be approximately $42 million, both of which would typically be used to fund additional grants were EDA not proposed for elimination but would be rescinded instead if EDA is retained in FY 2018. Based on past recoveries and the amount of current obligations by program, EDA expects the largest portion of its recoveries will be in Public Works and the next largest portion will come from Economic Adjustment Assistance. Disaster supplemental funds would not be included in the rescission as they come from a separate appropriation. EDA will not know the exact spread of the rescission until it realizes recoveries in FY 2018.

12. On the White House web site, a March 15, 2017 blog posting noted that "The President is traveling to Michigan today, delivering on his campaign promise to bring back jobs and rebuild America's manufacturing base." The very next day, the Trump Administration released the outline of its fiscal year 2018 budget request, which includes a proposal to eliminate the Manufacturing Extension Partnership (MEP) program. According to a recent analysis done by the Upjohn Institute in cooperation with the MEP Centers, the MEP program helped create and retain more than 80,000 manufacturing jobs across the

country in 2015, including more than 2,500 manufacturing jobs in the state of Michigan alone—the state that President Trump visited the day before issuing the proposal to eliminate MEP. The MEP program has been successfully creating and retaining tens of thousands of American manufacturing jobs every year for nearly thirty years. Yet the Trump Administration and the Commerce Department are pushing to eliminate this program, despite the President's statements about desiring to bring back manufacturing jobs. Why the inconsistency? Why is the Department (and the wider Trump Administration, for that matter) involved in the sending of contradictory messages to the American public? During the formulation of the fiscal year 2018 budget request, did the Department alert the White House or the Office of Management and Budget to the reality that the MEP budget request for fiscal year 2018 contradicts earlier statements from the Trump White House?

ANSWER:

The eliminations and reductions are consistent with the approach throughout the FY 2018 budget to focus on core Federal missions and reduce funding, such as grants, for programs that should be supported by non-Federal funding sources.

13. In addition to promising to rebuild the nation's manufacturing base, President Trump also issued an executive order on April 25, 2017 that among other things seeks to promote rural prosperity in America. At the same time, however, the Commerce Department's fiscal year 2018 budget justification, in the section on the elimination of the Manufacturing Extension Partnership (MEP) program, points out on page NIST-64 that after the MEP program is eliminated "approximately 9,400 [MEP] client [manufacturing] firms will need to find services elsewhere, and 25 states with clients in primarily rural areas may not be able to provide alternative services." If the Trump Administration and the Commerce Department are committed both to revitalizing American manufacturing and to ensuring the prosperity of rural America, why is the Commerce Department proposing to end a vital lifeline for small and medium-sized manufacturers, especially in rural areas?

ANSWER:

The Administration is committed to bringing jobs back and to increasing jobs in existing US businesses. I share the commitment to those activities. However, there is a limited amount of funding and difficult decisions to be made. The elimination of federal funding for the MEP program does not destroy the fundamental missions of the Commerce Department, and federal support for MEP centers was intended to be temporary when the program began decades ago. We believe that some local MEP Centers may continue to serve manufacturers without federal support and transition to non-federal revenue sources.

14. The Trump Administration's fiscal year 2018 budget blueprint, released in March, argues for the elimination of the Manufacturing Extension Partnership program by asserting that under this proposal, "MEP centers would transition solely to non-Federal sources, as was

originally intended when the program was established." Secretary Ross made this same argument at the May 25, 2017 hearing before the House Appropriations Subcommittee on Commerce, Justice, Science, and Related Agencies. Yet the Department's detailed fiscal year 2018 budget justification acknowledges that the MEP program was reauthorized by Congress in the American Innovation and Competitiveness Act (Public Law 114-329), signed into law in January 2017. That law expressly authorizes the Secretary of Commerce to provide financial assistance for the creation and support of MEP Centers. Aren't the Trump Administration and the Commerce Department, in making this argument for the elimination of the MEP program, ignoring the clear intent of Congress as expressed in Public Law 114-329?

ANSWER:

The budget must be about priorities. Even though MEP has certainly performed a good function, we chose to increase spending for defense and military to protect our national security and believe any further funding for MEP centers should come from non-Federal sources. We are in a challenging budget period and difficult budget decisions had to be made.

15. To offset the $477,000 cost of inflationary increases requested for the Commerce Department's Office of Inspector General (OIG), the OIG would not be able to fill vacancies for 2 auditors and 1 criminal investigator. This means that fewer audit reports will be produced and fewer cases will be investigated, compared to a budget that would allow these vacancies to be backfilled. What is the risk to the taxpayer that this assumed savings of $477,000 in fiscal year 2018 could very likely be far outweighed by a much larger amount of contractor fraud, improper payments, and other cases of malfeasance, as the OIG would miss certain opportunities to detect and prevent waste, fraud, and abuse?

ANSWER:

As a result of the reduction, OIG would expect that approximately $2.4 million in recoveries, fines, restitution, funds that could be put to better use and other forms of financial benefits would be foregone at OIG's current return on investment. However, OIG is working diligently to improve its return on investment and by FY 2018 we expect that the benefits missed as a result of the reduction would be higher. Also, OIG would conduct fewer investigations of complaints, would not be able to proactively investigate likely areas of fraud, waste, and abuse, and would refer more complaints back to the bureaus for bureau investigation and action as the bureaus deem appropriate.

16. The Trump Administration's budget request proposes to save money by scaling back several of the Census Bureau's most widely used surveys. To name one example, the fiscal year 2018 budget submission would reduce the sample size of the Survey of Income and Program Participation (SIPP). This will greatly impact the quality of the data from this survey. The SIPP is vital for government policy analysts, as it provides information on the success of government assistance programs. It also provides the most extensive information available on how the nation's economic well-being changes over time. Does the Department agree with me that lowering the quality of the data produced

by the SIPP is not in the best interest of anyone who expects government assistance programs to operate properly?

ANSWER:

The Census Bureau has analyzed the statistical quality of the smaller sample size. A 31,900 household sample does affect our ability to provide reliable estimates for analysis of subgroups and for analyses of program-use and other characteristics. While the smaller sample affects the statistical power for SIPP data and limits the ability to produce state-level data, it is important to note that, even at the larger sample size, state-level data were only available for the 15 largest states. However, the Census Bureau believes that 31,900 households is the minimum sample size that will enable the survey to remain statistically sound and provide information at the national-level on the use and eligibility for government assistance programs, and to provide the economic and social context around income and program participation.

17. Has the Department done an analysis of the extent to which the SIPP's data quality would be reduced under the funding scenario contemplated by the Department's fiscal year 2018 budget request?

ANSWER:

Yes, the Census Bureau has analyzed the statistical quality of the smaller sample size. A 31,900 household sample affects our ability to provide reliable estimates for analysis of subgroups and for analyses of program-use and other characteristics. We are using the number of states which could have reliable estimates for poverty as a measure of the data quality that each given sample size would support. With the sample used in the 2014 SIPP Panel (a 53,000 household sample), we would have the ability to reliably estimate key characteristics (like the proportion in poverty) for 15 states. A smaller sample, at the proposed 31,900 households, drops the ability to estimate poverty reliably to only 2 states (Michigan and Illinois in the current design). The lower sample size still produces statistically sound information at the national level, but the smaller sample reduces the ability to provide statistically reliable estimates for small groups.

18. The Census Bureau has said that it would consider incorporating the canceled field elements from the 2017 Census Test into the 2018 End-to-End Test. One of the canceled 2017 tests was the Puerto Rico Census Test, which was originally aimed at testing address canvassing, as well as how internet self-response integrates with other methods of collecting responses. It was also aimed at testing data collection modes in Spanish to ensure efficient and effective data collection operations. Is the Census Bureau considering doing a Puerto Rico Census Test as part of its testing going forward?

ANSWER:

The 2018 End-to-End Census Test will begin with address canvassing operations in August 2017 in three sites – Bluefield-Beckley-Oak Hill, West Virginia; Providence County, Rhode Island; and Pierce County, Washington. Following address canvassing operations, the remainder of the test will continue in Providence County, Rhode Island. The Providence site best covers the characteristics originally considered during site selection for the 2018 End to End Census test and will allow the Census Bureau to test the integration and function of operations and systems. Providence County, Rhode Island, is an urban site that has high vacancy rates. There is a solid presence of group quarters, and strong demographic diversity with sizeable African American and Hispanic populations.

While this does not include a site in Puerto Rico, the Census Bureau is confident that its testing strategy in 2017 and 2018 is providing ample opportunity to prove in and refine its methods for data collection in Spanish across all response modes and operations. The test will not allow the Census Bureau to work with Puerto Rico's different address format.

In the 2018 End-to-End Census Test, the Census Bureau will conduct 24 of its 35 operations for the 2020 Census, including for the first time this decade Update Leave and Group Quarters. Address canvassing operations begin in August of 2017, self-response across all modes in English and Spanish begin in March 2018, and nonresponse follow-up operations begin in April and May of 2018. Additionally, this is the first opportunity to test production of the prototype data products required by Public Law 94-171.

19. Please explain the ways in which the Census Bureau's integrated partnership and communications efforts for the 2020 Census will differ from the efforts that preceded the 2010 Census. In what ways does the Census Bureau anticipate these efforts will be more effective than before? Does the Census Bureau believe that these efforts will be developed and implemented earlier in the cycle than was the case with the last decennial census, in order to maximize the effectiveness of these efforts, as recommended by the official summary evaluation of the 2010 Advertising campaign?

ANSWER:

One of the major lessons learned in the evaluation of the 2010 Census partnership and communications program was that planning and engaging earlier in the decade would be a major driver to continued improvement for the 2020 Census. While the Census Bureau did award the contract for these efforts earlier in the decade – in 2016 – funding shortfalls have limited the amount of funding available for the program in 2016-2018. As a result, only limited activities have taken place and advertising will no longer be included in the 2018 End-to-End Census Test. However, the Census Bureau is still planning the program for the 2020 Census, in consultation with the vendor, and is ahead of where the program was leading up to the 2010 Census. A communications plan will be released later this summer, offering a roadmap for 2020 Census communications one full year earlier than during the 2010 Census. The Census Bureau expects the plans outlined in this document to fully address Census advertising and partnerships in a landscape that is more reliant on technology than ever before in how we communicate and receive our information.

In addition, the Census Bureau, together with the communications contractor, is launching the 2020 Census Barriers, Attitudes and Motivators Survey (CBAMS 2020) over the next six months. CBAMS is an innovative effort that combines quantitative and qualitative data collection to identify factors that impede and assist individuals to respond to the census. Different from the 2010 CBAMS, this time a strong qualitative component will include focus groups, online discussion groups, and in-depth interviews with community leaders to explore high-level message themes and platforms. This innovation will be fundamental in reaching hard to count and hard to reach populations in the most isolated areas of the country.

Partnership activities at both the national and local level have started. While budget constraints have limited the current scope of these activities, the Census Bureau is still further along than they were in the 2010 Census, as they have already filled some positions, conducted background research, and started the development of relationships with both national corporations and local communities.

In the 2020 Census, the Census Bureau will allow people to respond to the Census without an identification coded provided to them ahead of time. The Census Bureau refers to this as "Non-ID Processing." This means that when people log onto the Internet, or call the telephone centers, the Census Bureau can collect their data by using a system that allows it to verify the addresses callers provide to us against the address database in real time. This is an important innovation that will be particularly helpful in efforts to reach traditionally undercounted populations.

Through the Partnership Program, the Census Bureau will work closely with national, state, local and tribal stakeholders that people trust to help communities understand the importance of responding to the census. Literally hundreds of thousands of census partners join together during the census to help people understand the importance of being included in the final counts. Now, thanks to Non-ID Processing, Census Partners will be able to help people respond to the census in real time, at events or get-togethers, simply by having them respond via their smart phones, or kiosks they set up, or by helping them respond using technologies they provide (like tablets or computers).

In addition to the well-tested methods of engagement from previous censuses, the Census Bureau will explore communications and engagement efforts across all technological platforms, including data-driven and consumer-centric communications and advertisements. The use of research will be key in developing targeted outreach strategies designed to reach households clusters at the very local level when most needed, saving millions of dollars to the Census Bureau. Both digital advertising and social media will be crucial elements of this innovation. The Census Bureau, in service to an accurate count in the 2020 Census, must continue to adapt its practices for communicating with and reaching the American people each and every decade, but especially so in this transformative decade, so the Census Bureau can meet its goal of maximizing the self-response rate nationwide as well as amongst the hardest to reach populations.

20. Does the Department's fiscal year 2018 request assume a lower overall level of effort for integrated partnership and communications efforts throughout the life cycle of the 2020 Census, compared to: (a) what was contemplated for the 2020 Decennial Census prior to the submission of the fiscal year 2018 budget request, or (b) what was conducted as part of the 2010 Decennial Census? If the answer to either of these is "yes", to what extent does the Department anticipate that this reduced level of effort for integrated partnership

and communications efforts will lead to higher 2020 Decennial Census life cycle costs, especially in future years and specifically in the form of higher nonresponse follow-up operation expenses? Has the Department conducted an analysis of the impact on nonresponse follow-up requirements associated with reductions in integrated partnership and communications efforts?

ANSWER:

One of the major lessons learned in the evaluation of the 2010 Census partnership and communications program was that planning and engaging earlier in the decade would be a major driver to continued improvement for the 2020 Census. The Census Bureau awarded the contract for these efforts earlier in the decade – in 2016 – but funding constraints have limited the amount of funding available for the program so far. As a result, only limited activities have taken place. However, a communications plan will be released the fall of 2017, offering a roadmap for 2020 Census communications one full year earlier than during the 2010 Census. The Census Bureau expects the plans outlined in this document to fully address improved Census advertising and partnerships in a landscape that is more reliant on technology than ever before in how we communicate and receive our information.

In terms of specific impacts on future costs, as I indicated in my testimony, the Department is currently reviewing the life cycle estimate for the 2020 Census. I will report back to the Committee when I have a number that I am confident accurately estimates both the likely cost of the 2020 Census and a worst-case scenario and what that means for the Census Bureau's funding needs for the rest of the decade.

21. In anticipation of technological improvements, the Census Bureau announced plans to reduce its decennial census footprint from 12 regional census centers and almost 500 area census offices in 2010, down to just 6 regional census centers and no more than 250 area census offices for the 2020 decennial census. However, at the most recent Program Management Review, the Bureau identified a new risk—"Increased Workload for the Address Canvassing Operation." What, if any, impact will this risk have on the projected $900 million cost avoidance associated with more efficient address canvassing? What insights did the Bureau gain from the 2016 Address Canvassing test? Based on the research and testing that the Census Bureau has conducted thus far, is the Bureau still confident that it will be able to achieve its projected cost reduction in the decennial census field infrastructure, compared to continuing the practices of previous decennial censuses?

ANSWER:

During the 2017 continuing resolution, in order to fully fund all the highest priority mission critical systems development, systems integrations, testing, and infrastructure that must be accomplished ahead of the 2018 End-to-End Census Test throughout the fiscal year regardless of final appropriation, the Census Bureau made a number of design changes to other parts of the 2020 Census. This plan allowed the Census Bureau to remain on track by prioritizing and preserving the most critical funding investments for systems development and field infrastructure build-out ahead of the 2018 End-to-End Census Test, as well as for executing the testing needed to ensure system interoperability.

One of the decisions required to prioritize these critical activities suspended a portion of the innovative new design for the In-Office Address Canvassing (IOAC) operation, known as the Active Block Resolution (ABR) operation at our National Processing Center until after the 2020 Census.

The Census Bureau plan for IOAC had consisted of two phases: Interactive Review (IR) and ABR. During the first phase, IR staff conducted an assessment of the stability of the housing unit inventory at the census block level, using satellite imagery and housing unit counts from the Census Bureau's Master Address File. Census blocks that had not experienced change were designated as "stable." Census blocks that had experienced change were designated as "active" and moved to the second phase, ABR. ABR constituted a deeper dive into the blocks that IR determines to be "active" and required further resolution.

The impact of the decision to suspend Active Block Resolution changes the Census Bureau's estimate for In-Field Address Canvassing required from 25 to 30 percent of blocks. While this additional fieldwork would have increased the overall estimated cost of the 2020 Census, the Census Bureau is looking at implementing several additional efficiencies in address canvassing to keep cost avoidance associated with Reengineering Address Canvassing close to the previous estimate of $900 million.

Although ABR will not be a part of the 2020 Census, the Census Bureau will continue to research improvements that will streamline the operation to increase productivity and quality control, and expect ABR to contribute to address canvassing efficiencies for the 2030 Census.

Based on research, testing, and operational experiences, the Census Bureau remains confident in its ability to accurately canvass 70 percent of the Nation's blocks using geospatial technology and partner data in the office with Interactive Review alone. This compares to the 2010 Census where no blocks were completed in the office, and all required field listing. The Census Bureau anticipates reporting results of the Address Canvassing Test in the coming months, and will be further testing the redesigned address canvassing operation in the 2018 End-to-End Census Test in Bluefield-Beckley-Oak Hill, West Virginia; Pierce County Washington; and Providence County, Rhode Island.

22. To what extent will the Department's planned delays in opening 2020 Census regional and area census offices (as assumed in the fiscal year 2018 budget request) simply increase costs in fiscal years 2019 and 2020, and likely by far more than the assumed "savings" associated with these delays in fiscal year 2018? Please provide the changes in outyear budget projections specifically associated with the delays in the acquisition and opening of these offices as assumed in the fiscal year 2018 budget submission.

ANSWER:

As I indicated in my testimony, the Department is currently reviewing the life cycle estimate for the 2020 Census. I will report back to the Committee when I have a number that I am confident accurately estimates both the likely cost of the 2020 Census and a worst-case scenario and what that means for the Census Bureau's funding needs for the rest of the decade.

23. To what extent will the Department's decision to reduce the Census Bureau's number of 2018 end-to-end test sites from three to one, as spelled out in the fiscal year 2018 budget request, increase the risk of information technology failure or other problems with 2020 Census preparation, and thus leading to higher 2020 Census lifecycle costs especially in future years, compared to the previous plan of three test sites? Has the Department done an analysis of the potential budgetary and operational risks associated with reducing the number of end-to-end test sites?

ANSWER:

The decision to descope the two sites from the 2018 End-to-End Census test will not increase the risk of information technology failure in the 2020 Census. The CEDCaP program's focus in FY 2018 will be to provide capabilities to support the 2020 Census by deploying multiple systems into production to support the End-to-End Census Test. These include several capabilities supporting the Address Canvassing Internet response and field data collection operations. CEDCaP will also provide defect resolution and "bug" fixes to those capabilities to be ready for the 2020 Census. Finally, it will begin testing to ensure that when scaled to the workload of the 2020 Census, the systems function efficiently.

Regarding 2020 Census operations, 24 of the 35 operations planned for the 2020 Census, and the IT capabilities needed for those operations, will be tested in the End-to-End Test. Many of the remaining operations are either underway (such as the Local Update of Census Addresses) or are not relevant to the test, such as redistricting and archiving.

24. The Government Accountability Office (GAO) has noted that while the Census Bureau has made substantial progress in revamping its approach to the census and testing the new 2020 Census design, considerable challenges and uncertainties remain in: (1) implementing the cost-saving innovations; (2) managing key IT systems, including ensuring their security, to support the census; and (3) developing a quality cost estimate for the 2020 Census. For these reasons, the 2020 Census is a GAO high-risk area. Please describe the efforts of the Commerce Department and Census Bureau to address GAO's recommendations in these areas.

ANSWER:

As the final years of the decade approach, monitoring and mitigating risks at the Census Bureau is among the most important things being done to ensure the Census Bureau can execute its plan for a fair and accurate 2020 Census.

In recognition of the complexity, scale and importance of conducting a fair and accurate count of the Nation each decade, GAO added the 2020 Census to its high risk list. They included Census 2000 and the 2010 Census on their list as well.

Plans to address risks in the program includes:

- Department and OMB officials are carefully reviewing the program and implementing an oversight plan designed to recognize and manage risks.
- Census Bureau leaders have standing appropriate governance structures including the weekly 2020 Executive Steering Committee and the 2020 Systems and Alignment meetings, which facilitates Census Bureau leadership engaging in regular risk mitigation.
- The Census Bureau and the Department are analyzing the root causes of the issues encountered, developing action plans to address these and measuring progress.
- The Census Bureau is actively working to address and close recommendations from GAO and the Department's Office of Inspector General.
- The Census Bureau monitors risks internally and welcomes stakeholders into the process. Specifically, the Census Bureau:
    - Holds quarterly Program Management Reviews that are open to the public.
    - Has documented largest decisions in the 2020 Census Decision Memorandum Series.
    - Lists all decisions that have been made so far, along with the timeline for making those that remain in the 2020 Census Operational Plan, last updated in October 2016.
    - Shares the 2020 Census Integrated Master Schedule with GAO on a monthly basis.

Another related and equally important component to success is collaboration with the Congress and at GAO to continually review and assess our designs, plans, systems, and operations to identify areas of improvement.

25. The American Community Survey (ACS) collects data that is either (1) mandated by federal law, (2) required to implement a federal program, and the ACS is the only source for the data, or (3) required to carry out a federal court order. What would be the alternative if the ACS were eliminated or greatly reduced, such that the Census Bureau could not produce data for many areas, such as rural counties, small cities and towns, American Indian reservations, remote areas, and urban neighborhoods? Is it possible for the business sector to replicate the breadth and depth of data the ACS produces, for every community in the country? Would businesses charge Congress and federal agencies to use the data under this scenario?

ANSWER:

The elimination of the American Community Survey would be a loss to our national information infrastructure. There is no alternative that provides the rich detailed data that the ACS produces, especially for rural areas. Losing the ACS would cause far-reaching damage on businesses that use ACS data to determine where to locate their operations and decide what products to put on their shelves; state and local economic development agencies that use ACS data to attract businesses, to make decisions, and to manage growth; first responders who use ACS data to assess impacts and prioritize recovery efforts; and by Federal agencies like the Department of Veterans Affairs, which uses ACS data to evaluate the need for health care, education, and employment programs for those who have served in the military. Finally, Federal agencies are also required to allocate over $400 billion per year in federal funding using data that is only collected by the ACS.

It is difficult to envision the private sector providing the data at levels of detail that the ACS produces, while enabling users to access that data at low or no cost. The ACS serves a number of inherently governmental functions, including providing data that informs distribution of over $400 billion a year in federal funding. The distribution of these funds need to be based on objective and reliable data. Additionally, the confidentiality and privacy of all respondents' personal information must be ensured, and the Census Bureau has built a reputation as protectors of respondent confidentiality and privacy. It is important to avoid concerns about monetizing the collection and securing of these data. Additionally, continued access to ACS data to businesses large and small, new and well-established, ensures that it can continue being a driver of economic growth throughout the private sector.

26. Likewise, would it be possible for state and local government officials to replicate a dataset similar to the ACS to use for their unique planning and policy purposes?

ANSWER:

If state and local governments were to conduct a similar survey, it would only cover those jurisdictions and would likely not provide data that was comparable across the Nation at all geographic levels.

27. In 2003, the Census Bureau, at the behest of Congress, conducted a study, analyzing the feasibility of making participation in the American Community Survey (ACS) voluntary. The study determined that making the survey voluntary would reduce the response rate by at least 20 percent and increase annual costs by 30 percent ($90 to $100 million more per year). Canada's recent experience with a voluntary census long form generated similar results, as its survey's overall response rate dropped from 94 percent to less than 69 percent, while costs increased, and low response rates precluded Statistics Canada from producing reliable socio-economic estimates for 25 percent of all areas in the country—mostly small and rural communities. What are the Department's views regarding the mandatory response status of the ACS?

ANSWER:

The Census Bureau has heard the concerns of Congress and members of the public and is actively working to address these and reduce respondent burden. The ACS is mandatory because it is part of the decennial census. The Census Bureau knows response rates suffer when a survey is voluntary and this has a negative impact on the reliability of the data, especially for rural and small communities and small population groups.

Businesses, including such well-known companies as Target, JC Penney, Best Buy, General Motors, Google, and Walgreens, use ACS data for everything from marketing to choosing franchise locations to deciding what products to put on store shelves. Because ACS data are available free of charge to the entire business community, the program helps lower barriers for new business and promotes economic growth. First responders and law enforcement agencies use ACS data during natural disasters and emergencies to assess impacts and prioritize recovery efforts; for example, the Federal Emergency Management Agency (FEMA) used ACS data for Hurricane Sandy Relief Efforts. State and local economic development offices use ACS data to attract businesses, make decisions, and manage growth. Finally, Federal agencies are also required to allocate over $400 billion per year in federal funding using data that is only collected by the ACS. The reliability of ACS data is vital for all of these uses.

When Canada switched a survey similar to the ACS from mandatory to voluntary, Canada lost the ability to publish data for many rural areas. To compensate for a similar effect here, it would cost approximately $90 million more each year to maintain our current data quality.
The Census Bureau's strategy is to convince people to participate by explaining the importance of the data to their community rather focusing on fines or jail time. Although a fine for non-response is established in the U.S. code, the Census Bureau has never asked for the fine to be enforced.

28. To what extent are pay differentials between public sector and private sector information technology experts impeding any of the Census Bureau's work? Please provide information on the efforts of the Census Bureau to ensure it attracts and retains talented information technology personnel.

ANSWER:

There are specific IT skills, such as highly experienced network engineers and cyber security professionals who are skilled at threat protection and deterrence, for which the private sector are able to pay a premium. Pay differentials with the private sector can make it difficult for Census to obtain the same critical IT skill sets through hiring. So, the Census Bureau has leveraged the use of contracts to mitigate the risks associated with obtaining the appropriate IT skills and talent to support its programs. The Census Bureau is using training and mentoring opportunities, as well as pay setting based Superior Qualifications to compete with private industry salary for some positions.

29. To what extent will the 9-12 month delay in the schedule for the 2017 Economic Census, as contemplated in the Department's fiscal 2018 budget request, increase the overall life cycle cost of the 2017 Economic Census?

ANSWER:

The Census Bureau does not anticipate that the 6 to 9-month delay we currently estimate will add to the overall life cycle cost of the 2017 Economic Census. However, mailing later will push some of the data collection and processing costs into FY 2019. While this is a delay from the planned schedule, it is important to note that for the economic census, unlike the decennial census, there is no fixed deadline for completion of the data releases. The requested funding level in the FY 2018 budget will allow the Economic Census and Census of Governments to remain on track to release high quality data that will fulfill their primary purpose to provide benchmark data for the monthly, quarterly, and annual economic statistics – including measures of Gross Domestic Product – that are so vital to the functioning of our economy.

30. By what future date does the Department anticipate the Commerce Department's headquarters building will have completed its renovations?

ANSWER:

The HCHB Renovation project is scheduled to complete in May 2026. This includes updating previously renovated spaces (phases 2 and 3) to the 21st Century Workplace design which improves space utilization, decreases reliance on leased space, and reduces the government's footprint.

31. The Trump Administration's fiscal year 2018 budget eliminates Coastal Zone Management Grants. These grants go to coastal and Great Lakes states to help address coastal hazards, natural resource conservation, marine debris, and other urgent coastal and Great Lakes issues. For example, in fiscal year 2016:

- Alabama received $1.5 million under the Coastal Zone Management grants program;
- Florida received $2.7 million;
- Georgia, $2.4 million;
- Indiana, $1 million;
- Louisiana, $2.6 million;
- Mississippi, $1.2 million;
- North Carolina, $2.6 million;
- Ohio, $1.8 million;
- Pennsylvania, $1.8 million;
- South Carolina, $2.5 million;
- Texas, $2.6 million; and
- Wisconsin, $2.3 million.

In the 2016 presidential election, President Trump was the top vote-getter in all of these states. Does the Department believe that the 2016 election gave the Trump Administration a mandate to push for elimination of Federal support for Coastal Zone Management Grants, especially for these particular states?

ANSWER:

The proposed elimination of this program is not directed at any particular state nor fueled by the 2016 election. NOAA distributes Coastal Zone Management Grants based on a formula that accounts for each state's shoreline length and coastal population. The President's FY 2018 Budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, some difficult decisions needed to be made, including the decision to terminate this grant program.

32. As part of the fiscal year 2018 Commerce Department budget request, the Trump Administration is proposing to eliminate the Deep-ocean Assessment and Reporting of Tsunamis (DART) buoys, which help detect and warn about impending tsunami events. How much does the Department project it will save in fiscal year 2018 by ending support for the DART buoys? On the other hand, to what extent will this reduction increase the risk of American communities being unprepared for a potentially devastating tsunami event? On the flip side, to what extent will the elimination of the DART buoys increase the risk of American communities being given unnecessary and costly evacuation orders related to poorly-measured and poorly-tracked tsunamis? Has the Department done any analyses of these various risks?

ANSWER:

NOAA projects it will save $12.0 million annually by ending support of the DART buoys as well as targeted seismic and water level stations that are used for tsunami watches and warnings. This termination is anticipated to have a 20 percent or greater impact on the accuracy, certainty, and timeliness of NOAA's tsunami watches and warnings. However, NOAA's analysis of the impacts suggests that the overall Tsunami Mission Service Area performance satisfaction score will be "fair", meaning that tsunami warning and watch forecasting ability will meet most, but not all, major requirements. In FY 2018, NOAA will continue to fund critical tsunami program components in order to ensure issuance of tsunami watches, warnings, and advisories.

33. What do the Department and the Trump Administration plan to do with the DART buoys after removing them from the water?

ANSWER:

NOAA will repurpose any components that can be utilized on other buoys systems that NOAA maintains. Otherwise, the remainder of the DART buoy components will be returned to a NOAA facility for disposal.

34. To what extent will the Trump Administration's proposal to terminate extramural research on harmful algal blooms increase the risk of such algal blooms, especially in the Great Lakes region and in Florida?

ANSWER:

The President's FY 2018 Budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, some difficult decisions needed to be made, including the decision to terminate this grant program. NOAA will no longer fund extramural research to explore ways to stop blooms before they start, find methods to stopping blooms once they have begun, and to predict how blooms will affect people and resources. However, the results of many years of extramural research funded by NOAA to better understand Harmful Algal Blooms (HAB's) have led to the development of state-of-the-art detection tools and forecast models that NOAA has successfully transitioned from research to operations and will continue to be used to help protect public health and mitigate adverse economic impact cause by HAB's. NOAA will also continue its related intramural research program that addresses priority coastal management issues, including harmful algal blooms.

35. The Department and the Trump Administration are proposing a huge cut to the Polar Follow-on weather satellite program, in comparison to both the fiscal year 2017 enacted level and to the level that the Department had earlier contemplated would be necessary for fiscal year 2018. To what extent does this cut increase the fragility of the future polar-orbiting weather satellite system? Has the Department done an analysis of the risks to future weather forecasting associated with greatly scaling back the Polar Follow-on program? Why are the Department and the Trump Administration proposing to scale back the Polar Follow-on program, when the Independent Review Team is recommending that it be strengthened?

ANSWER:

The President's FY 2018 Budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, some difficult decisions needed to be made. The impacts of the FY 2018 funding reduction to the Polar Follow On (PFO) program on the future polar-orbiting weather satellite system will be evaluated as part of the re-plan of the PFO program and the broader comprehensive architecture analysis, which will define the observing system options and programmatic approaches for the future. NESDIS must continue to work towards improving its overall constellation strategy for polar weather satellite continuity while seeking cost efficiencies. However, we do expect that with the lower budget profile NOAA will proceed with a higher constellation risk for this critical national asset.
The primary focus for NESDIS is providing uninterrupted, accurate, calibrated, and validated satellite observations supporting high impact environmental intelligence products and services. In FY 2018, NESDIS is ensuring the timely delivery of the highly capable Geostationary Operational Environmental Satellite-R (GOES-R) Series and Joint Polar Satellite System (JPSS)

satellites, which are currently in advanced stages of development and test, to ensure continued services in the near term.

36. Please explain how the Commerce Department will work to ensure the integrity, scientific independence, and freedom from outside interference for scientists of the National Oceanic and Atmospheric Administration.

ANSWER:

The NOAA Scientific Integrity Policy (NAO 202-735D), signed into effect in 2011, codifies the agency's policies for conducting and communicating scientific activities. Since establishing the policy, NOAA has also institutionalized procedures to "Increase Public Access to Research Results" and digital data, and for "Internal Review and Approval of Fundamental Research Communications" to better facilitate open scientific communication and the high quality of that communication. The Department of Commerce's longstanding commitment to absolute integrity in the conduct of science has been reaffirmed on multiple occasions by Secretary Ross. As Secretary Ross has stated publicly[1], science will continue to be left to scientists and the Department will continue to provide the public with as much factual and accurate data as is available.

[1] Letter from Secretary Ross to Senator Bill Nelson.
http://www.sciencemag.org/sites/default/files/documents/rossletter.pdf

37. The Trump Administration is proposing to eliminate NOAA's Office of Education, including NOAA's Educational Partnership Program with Minority Serving Institutions. As a result of this elimination, how many minority students will not be served and supported by this program, compared to the fiscal year 2017 enacted funding level? Please provide the numbers of students by category (i.e., Cooperative Science Centers, Undergraduate Scholarship Program, Graduate Research and Training Scholarship Program, and NOAA Experiential Research Training Opportunities). If necessary, please use the most recent available data.

ANSWER:

EPP funds support students with scholarships and internships through three programs at minority and majority academic institutions: the Cooperative Science Centers (CSC); the Undergraduate Scholarship Program (USP); and, the Graduate Research Training Scholarship Program (GRTSP), a pilot program sun setting in December 2017. The NOAA Experiential Research Training Opportunities are made available to students through the CSC funds.
The FY18 budget will eliminate support for 137 students, including 129 CSC students and 8 Undergraduate Scholars. In addition, there would be no funds for approximately 75 of the 137 CSC supported students to conduct internships at NOAA facilities and onboard research vessels through a NOAA Experiential Research and Training Opportunity.

38. The Trump Administration is proposing to eliminate NOAA's competitive education grants program. As a result of this elimination, how many students will not be served and supported by this program, compared to the fiscal year 2017 enacted funding level? If necessary, please use the most recent available data.

ANSWER:

As a result of the proposed elimination of the Competitive Education Grants program, at least 40,000 schoolchildren and 2,000 K-12 and informal educators will not be served by this particular program.

39. The Trump Administration is proposing to eliminate the Bay Watershed Education and Training (B-WET) program. As a result of this elimination, how many students will not be served and supported by this program, compared to the fiscal year 2017 enacted funding level? If necessary, please use the most recent available data.

ANSWER:

As a result of the proposed elimination of the NOAA B-WET program, at least 48,000 students and 3,600 teachers will not be supported by this program in FY18.

40. One of the many proposed cuts in the Trump Administration's fiscal year 2018 budget request for NOAA is a proposal to shut down NOAA's Air Resources Laboratory, which conducts research on air chemistry, mercury deposition, and atmospheric dispersion of harmful chemicals. These activities would be terminated. According to NOAA's own web site the Air Resources Laboratory's Atmospheric Dispersion Research Program "provides critical modeling and observation data to understand how, where, and when chemicals and materials are transported through the atmosphere. Having this understanding is essential for emergency managers and the aviation industry to respond appropriately to minimize or prevent disaster." Why are the Trump Administration and the Commerce Department proposing to close a research laboratory that currently serves a number of vital functions, much of it highly important to the nation's homeland security?

ANSWER:

The President's FY 2018 Budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, NOAA made some difficult decisions, including a decrease of $4.7 million for the Air Resources Laboratory (ARL), which will result in the closure of the lab and the potential elimination of 34 FTE. Core research functions conducted by ARL would be consolidated into other NOAA laboratories. Although NOAA will no longer support upgrades to the Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) model -- an atmospheric particle dispersion model -- the model will remain available for download and use, and NWS will continue to utilize HYSPLIT operationally when requested (e.g. a nuclear incident, volcanic eruption, and point release of hazardous materials - e.g. a train wreck).

41. To what extent will the Trump Administration's proposed cuts in National Weather Service Surface and Marine Observations reduce the accuracy and reliability of weather forecasts?

ANSWER:

Investments proposed in the FY18 Budget will continue to improve the accuracy and reliability of weather forecasts.

The Marine Observation buoys provide ground-truth measurement of ocean-surface weather conditions in tropical cyclones and improve our accuracy of tropical cyclone forecast products. NOAA will continue to carry out forecasts, however with less buoy area coverage for these products as well as reduced buoy area coverage for Hazardous Seas Warnings, Offshore Waters Forecast, Sea Surface Temperature Analysis, and Wind and Wave Graphical Analysis.

The reduction of the TAO buoys may delay recognition of the onset of an El Niño and the Southern Oscillation (ENSO) phenomenon and increase the uncertainty of seasonal weather forecasts issued around the world, in turn delaying the ability to mitigate impacts of drought or other conditions signaled by the ENSO phenomenon.

Surface observations through the National Mesonet Program will be reduced from all 50 states to prioritized areas most susceptible to tornadoes and severe weather; observations will be limited to surface meteorological observations and lightning.

42. Will the proposed elimination of the Aviation Science Research-to-Operations program render the National Weather Service unable to satisfy improvements requested by FAA and international stakeholders to support the Next Generation Air Transportation System (NextGen)?

ANSWER:

The President's FY 2018 Budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, NOAA made some difficult decisions, including elimination of the NWS Aviation Science Research-to-Operations program. While these funding cuts will render NWS unable to develop new capabilities needed in order to meet FAA NextGen requirements, NWS will maintain the current level of operational aviation weather forecast products and services.

43. The Trump Administration is proposing to terminate development, testing, and implementation of experimental products to extend operational weather outlooks from 16 days to 30 days. Specifically, NOAA will eliminate efforts to extend the predictability of extreme or high-impact weather beyond 10 days and will eliminate efforts to develop and

implement improved coupled global weather prediction models. Does the Department and the Trump Administration have any plan at all to improve the predictability of extreme or high-impact weather beyond the 10-day range or to extend operational weather outlooks beyond 16 days? If so, why is the Department proposing to eliminate this effort?

ANSWER:

NWS currently has a multi-year plan to develop and implement an operational capability for mid-range (weeks 3-4) outlooks of high impact weather events. Consistent with the President's intent to focus more resources on National and Homeland Security, the President's FY 2018 Budget required reductions in different elements of the NOAA budget. NOAA will continue to support sustaining improvement of severe weather warning and forecasting capability, but the mid-range forecasting improvement plan will be terminated in FY 2018.

44. Another proposed cut contained in the Trump Administration's fiscal year 2018 budget request is a reduction in NOAA's Competitively Funded Climate Research (within the Office of Oceanic and Atmospheric Research), which President Trump is targeting for a 36 percent cut below the fiscal year 2017 enacted level. For the year for which the most recent information is available, please provide a list of all the entities that received funding via the Climate Competitive Research program, along with the purposes and amounts.

ANSWER:

ATTACHMENT 3. – DOC CLIMATE COMPETITIVE RESEARCH.PDF

NOAA/OAR Climate Competetive Research

Entity (Recipient)	Entity (State)	Project Title	Project Description	Amount	Fiscal Year
Small Business Innovation Research (SBIR) Program	MD	Small Business Innovation Research (SBIR) Program	NOAA's SBIR Program is seeking highly innovative products with excellent commercial potential. All SBIR proposals must directly benefit the NOAA mission, but should also be responsive to the greater market demands in order to be successful. All SBIR applications must be made in response to a NOAA solicitation, which will be made available once per year on this site and through the Federal Register.	1,094,835	2016
GORDON RESEARCH CONFERENCES INC	RI	2016 Biogenic Hydrocarbons and the Atmosphere GRC	The 2016 Gordon Research Conference on Biogenic Hydrocarbons and the Atmosphere will take place at The PGA Catalunya Business and Convention Centre in Girona, Spain, from June 26-July 1, 2016 to address the various topics associated with biogenic hydrocarbons. The conference theme is Diversity of Sources, Sinks, and Impacts of Atmospheric Organics and will focus on the exchange of trace gases in the land-ocean-atmosphere system. Specific discussions will take place to identify current gaps in the present knowledge of hydrocarbon production in the land and marine biospheres, exchange with the atmosphere, and chemical processing in the Earth System. A primary conference goal is to discuss these ideas in a cross-disciplinary environment to trigger the development of new research strategies to resolve outstanding research questions on the role of biogenic hydrocarbons in regional and global climate change.	8,000	2016
Research Foundation of State University of New York, The	NY	A categorical assessment of forecast errors and biases in extended-range ensemble forecasts of stratospheric regime changes	Relevance to NOAA's MAPP competition and long-term climate goal: The proposedwork is highly relevant to the MAPP completion: Research to Advance Prediction of Subseaonalto Seasonal Phenomena (ID: 2542967) as it examines the ability of operational NWP systems torepresent underlying predictability sources, both physical and dynamical, that influence thesubseasonal phenomena of stratospheric regime changes. During the winter season tropospherestratospherecoupling provides a dynamic mechanism for the stratosphere to influence thetroposphere on subseasonal timescales. Stratosphere-troposphere coupling can manifest itself asa stratospheric regime change or, in extreme cases, a sudden stratospheric warming (SSW). Onsubseasonal timescales, SSWs have been linked to extreme weather and climate, such as cold airout breaks and negative Arctic Oscillation (AO), which can impact the U.S., Europe and Asia.When troposphere-stratosphere coupling is skillfully resolved in a forecast, it can providevalua	116,103	2016
University of Utah, The	UT	A CPT for Improving Turbulence and Cloud Processes in the NCEP Global Models	The proposed work will introduce two new physical parameterization schemes to the CFS/GFS model. One is a unified representation of turbulence, shallow convection and subgrid-scale clouds. The other is a unified representation of subgrid scale dee...	73,000	2016
University Corporation for Atmospheric Research	CO	A CPT for Improving Turbulence and Cloud Processes in the NCEP Global Models	The proposed work will introduce two new physical parameterization schemes to the CFS/GFS model. One is a unified representation of turbulence, shallow convection and subgrid-scale clouds. The other is a unified representation of subgrid scale dee...	12,000	2016
Colorado State University	CO	A CPT for improving Turbulence and Cloud Processes in the NCEP Global Models	The proposed work will introduce two new physical parameterization schemes to the CFS/GFS model. One is a unified representation of turbulence, shallow convection and subgrid-scale clouds. The other is a unified representation of subgrid scale dee...	70,000	2016
Rutgers, The State University of New Jersey - New Brunswick	NJ	A high-resolution physical-biological study of the Northeast U.S. shelf: Past variabilityand future change.	The ecosystem services of the northeast US region (e.g., fisheries, energy, tourism, recreation, health, etc.) are particularly vulnerable to climate change by virtue of their location at the confluence of the (cold) Labrador Current and the (warm) Gulf Stream, and a local rate of sea level rise predicted to exceed the global mean. Changes in climate will cause shifts in the location of the temperature fronts, water mass and associated biogeographic boundaries, ground and surface water distribution, directly affecting the ecosystem's structure and the associated resources (e.g., species' distributions). Understanding and quantitative projection of credible future scenarios will require sustained observations of the natural system as well as a modeling framework that represents the numerous oceanic components, the feedbacks between them, and resolves the scales important to variability within each sub-system. In this project we propose to study past variability and potential future chan	334,255	2016
University of Maryland, College Park	MD	A Subseasonal Excessive Heat Outlook System for CPC???s Global Tropics Hazards and Benefits Outlook (GTH)	The proposed work would develop a subseasonal excessive heat outlook system for the global tropics and subtropics with a forecasting period from week-one to week four by using the outputs from multiple models (e.g., GEFS, CFS, ECMWF, and Canadian Models). From an on-going project funded by NOAA, the PI has developed a prototype excessive heat outlook system for continental US and Alaska focusing on week one and two by using GEFS output only. This prototype system has two components: monitoring the intensity of excessive heat events and forecasting the probability of occurrence and intensity. This prototype will enter experimental operational phase in late spring 2016. The proposal will expand the prototype system to cover a larger domain (including global tropics and subtropics), a longer period, and would use more model outputs. The team would achieve their objective by executing three steps: 1) expand and refine the GEFS-based prototype monitoring system to cover the tropics and subt	145,000	2016

NOAA/OAR Climate Competetive Research

University of Washington	WA	Advancing understanding of sea ice predictability with sea ice data assimilation in a fully-coupled model with improved region-scale metrics	Predictions of sea ice on subseasonal to interannual timescales has the potential to be of widespread value if they are skillful at the lead times and spatial scales needed by forecast users. Understanding sea ice predictability is needed for high-stakes decision-making, such as arises in shipping, accessing resources, and protecting Arctic communities. Current prediction efforts have focused mainly on predicting total northern hemisphere sea ice extent (SIE), termed pan-Arctic SIE. To succeed at predicting regional scales requires significant new effort in three key areas. First, data assimilation techniques must be advanced to accurately initialize sea ice and other components at proper spatial scales. Second, metrics are needed to quantify the skill at the relevant spatial scales and for patterns of interest. Identifying key metrics is motivated by the expectation that a forecast system can't be improved without first developing adequate metrics for evaluating the features of import	248,589	2016
American Meteorological Society	MA	AMS/NOAA's Climate Program Office Fellowships	The primary purpose of this AMS/NOAA's CPO Graduate Fellowship is a highly competitive project to attract applications from only the top students in departments across the country in from the fields of atmospheric sciences, chemistry, computer sciences, engineering, environmental sciences, hydrology, mathematics, oceanography, and physics. On average, the AMS awards 12 fellowships per year, thus approximately 20% of the applicants actually receive awards. The fellowship recipients are typically in the top 5% of their class, they all present outstanding written references, and have clearly demonstrated their intent to pursue a career in the atmospheric, oceanic, or hydrologic sciences. The program has two goals: The first is to help ensure that outstanding young scientists enter the fields of the atmospheric and related oceanic and hydrologic sciences to meet the problems facing the nation and the world. The second is to provide sufficient resources to allow each recipient to pursue a	102,000	2016
WOODS HOLE OCEANOGRAPHIC INSTITUTION	MA	An Investigation of Abyssal to Mid-depth Variations in AMOC Properties and Transports through Observations and Assimilating Models	To understand the causes of decadal-scale variability in Atlantic overturning waters it is necessary to both recognize and connect the changes that are occurring in a moving ocean. That is, from a climate perspective, there is a need to use available information to better understand not only how ocean properties are changing, but also how dynamics may be affecting changes. While models and re-analyses look to provide a moving and even predictive three-dimensional picture, both correct and incorrect details are often lost in integration of available output and deep signals, in particular, may be missing from numerical integrations. On the other hand, observations capable of providing details on the characteristics of deep ocean properties and processes are, more often than not, disconnected from one another in time.Speaking to the AMOC competition's aim to refine present knowledge of the AMOC state, variability and change as well as NOAA's long term goal of an improved understanding of	547,401	2016
Aerosol Dynamics Inc.	CA	Analyzing Emitted Gases and Aerosols from Fires in the Western US and their Atmospheric Transformations	The proposed research aims to elucidate the speciated chemical composition and transformations of intermediate to low-volatility organic compounds emitted from BB. The FIREX study is being planned with a major focus on closing the gap in knowledge by providing unprecedented emission profiling coupled with plume tracking measurements and modeling to predict BBOA levels. Once these air masses are photochemically aged for hours to days, detailed chemical analyses including a full suite of organic aerosol source and product markers are needed to understand mass closure between modeled and measured organic aerosol. Through powerful chemical separation and identification techniques and by obtaining unprecedented hourly time resolution for chemically speciated measurements of oxygenated intermediate and semi-volatile organic compounds and particle phase organic compounds during FIREX, the PIs expect to make substantial progress in understanding the formation and transformation of wildfire imp	78,877	2016
Emory University	GA	Assessing the Terrestrial and Atmospheric Nitrogen Cycle	The goal of this project is to integrate observations and bottom-up as well as top-down modeling in an interdisciplinary way to address uncertainties in N2O modeling.	71,075	2016
The Regents of The University of Michigan	MI	Assessment of Atmospheric Aerosols Resulting from Oil and Gas Extraction Activities near the North Slope of Alaska	The proposed project will result in the first detailed characterization of atmospheric aerosols resulting from oil and gas extraction activities on the North Slope of Alaska. On-line aerosol measurement techniques will include: aerosol time-of-flight mass spectrometry (ATOFMS, real-time single-particle size and chemistry), aethalometer (on-line black carbon mass conc.), and scanning mobility particle sizer (size-resolved particle number conc.). Off-line filter-based aerosol samples will be analyzed for elemental carbon and organic carbon content, inorganic ions, organic molecular tracers, and modern vs. fossil carbon (radiocarbon analyses). In particular, ATOFMS will distinguish in real-time between combustion sources, including residual fuel, diesel fuel, and wildfires to provide source apportioned particle number conc. Backward air mass trajectory analysis will support source identification. The combination of real-time, single-particle identification and number apportionment with of	118,711	2016

NOAA/OAR Climate Competetive Research

Baylor University	TX	Assessment of Atmospheric Aerosols Resulting from Oil and Gas Extraction Activities near the North Slope of Alaska	The proposed project will result in the first detailed characterization of atmospheric aerosols resulting from oil and gas extraction activities on the North Slope of Alaska. On-line aerosol measurement techniques will include: aerosol time-of-flight mass spectrometry (ATOFMS, real-time single-particle size and chemistry), aethalometer (on line black carbon mass conc.), and scanning mobility particle sizer (size-resolved particle number conc.). Off-line filter-based aerosol samples will be analyzed for elemental carbon and organic carbon content, inorganic ions, organic molecular tracers, and modern vs. fossil carbon (radiocarbon analyses). In particular, ATOFMS will distinguish in real-time between combustion sources, including residual fuel, diesel fuel, and wildfires to provide source apportioned particle number conc. Backward air mass trajectory analysis will support source identification. The combination of real-time, single-particle identification and number apportionment with of	81,129	2016
The Regents of The University of Michigan	MI	Basin-wide top-down estimates for CH4 emissions from oil and gas extraction using aircraft observations	The proposed work will produce aircraft-based flux estimates of CH4 emissions from theSan Juan basin in New Mexico, which is the largest coalbed methane production region in the world. Observations will be made from the NOAA Twin Otter aircraft equipped with continuous measurements of methane (CH4), ethane (C2H6), carbon monoxide (CO), carbon dioxide (CO2), wind, temperature and relative humidity along with discrete flask measurements of these trace gases and 40 other species, including isotopes of CH4, to understand the origin of the measured CH4 emissions. The ability to make 1Hz C2H6 measurements on a small aircraft is a newly developed technique we have recently demonstrated in the Barnett shale in Texas. This measurement provided decisive information about the presence of fossil vs. non-fossil CH4 sources, and also clearly distinguished CH4 emissions associated primarily with oil production (high C2H6) from those associated primarily with gas production (low C2H6). Deliverables in	88,345	2016
The Regents of the University of Colorado	CO	Basin-wide top-down estimates for CH4 emissions from oil and gas extraction using aircraft observations	The proposed work will produce aircraft-based flux estimates of CH4 emissions from the San Juan basin in New Mexico, which is the largest coalbed methane production region in the world. Observations will be made from the NOAA Twin Otter aircraft equipped with continuous measurements of methane (CH4), ethane (C2H6), carbon monoxide (CO), carbon dioxide (CO2), wind, temperature and relative humidity along with discrete flask measurements of these trace gases and 40 other species, including isotopes of CH4, to understand the origin of the measured CH4 emissions. The ability to make 1Hz C2H6 measurements on a small aircraft is a newly developed technique we have recently demonstrated in the Barnett shale in Texas. This measurement provided decisive information about the presence of fossil vs. non-fossil CH4 sources, and also clearly distinguished CH4 emissions associated primarily with oil production (high C2H6) from those associated primarily with gas production (low C2H6). Deliverables i	73,462	2016
University of North Carolina, Chapel Hill	NC	Characterizing Oxidized North American Fire Emissions and Their Aqueous/Multiphase Atmospheric Transformations through the FIREX Campaign	The goal of this project is to measure oxidized gas- and particle-phase emissions, poorly characterized to date, at the Fire Science Laboratory (FSL) as part of FIREX. The PIs will conductcontrolled multiphase chemistry experiments at UNC with the complex mixtures of gases collected during FSL burns, to better understand the atmospheric transformation of fire emissions, their aerosol formation and optical properties. The PIs will apply their expertise in aqueous multiphase (heterogeneous) organic chemistry, organic chemical characterization, synthesis, and kinetics to achieve the following Specific Aims:(1) Identify oxidized gaseous and particulate organics at the molecular level during planned FSL burns by on- and off-line high-resolution mass spectrometry techniques.(2) Study SOA formation through cloud processing in pyrocumulus by scrubbing gaseous fire emissions into water (using mist chambers) and conducting aqueous oxidation and dropletevaporation experiments with and without add	198,946	2016
University Corporation for Atmospheric Research	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	92,089	2016

NOAA/OAR Climate Competetive Research

University Corporation for Atmospheric Research	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	145,254	2016
University Corporation for Atmospheric Research	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	57,089	2016
University Corporation for Atmospheric Research	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	96,203	2016
University Corporation for Atmospheric Research	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	88,186	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	23,900	2016

NOAA/OAR Climate Competetive Research

UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation; The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	128,051	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	42,000	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	54,203	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	150,000	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	131,516	2016

NOAA/OAR Climate Competetive Research

UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	391,943	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	(23,900)	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	(128,051)	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	(42,000)	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	(54,203)	2016

NOAA/OAR Climate Competetive Research

UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	(150,000)	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	(131,516)	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	(391,943)	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	23,900	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	128,051	2016

NOAA/OAR Climate Competetive Research

UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	42,000	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	54,203	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	150,000	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	131,516	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	391,943	2016

NOAA/OAR Climate Competetive Research

UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	25,000	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	15,000	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	191,842	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	15,000	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Climate Adaptation and Mitigation Program (CAMP)	The NOAA Climate Program Office invites applications for a collaborator to partner in the systematic study of the structure and behavior of the ocean, atmosphere, and related ecosystems; and the communication of data, information, and knowledge to others for use in their businesses, communities, and daily lives. The collaborator will focus on the themes of 1) Climate Adaptation and Mitigation: The impacts of a changing climate on the Nation's ocean and coastal ecosystems, which include living marine resources, salt and freshwater resources, as well as coastal communities; 2) Improved Scientific Understanding of the Changing Climate system and its Impacts: The need to advance understanding of the climate system and climate impacts, improve climate predictions and projections, and better inform adaptation and mitigation strategies; 3) Assessments of Current and Future States of the Climate System: Stakeholders and the general public need a clear understanding of the best available scien	235,000	2016

NOAA/OAR Climate Competetive Research

University of Reading	NA	Collaborative Research: Assessing Oceanic Predictability Sources for MJO Propagation	The body of evidence from decades of work suggests a paradigm of the MaddenJulianOscillation (MJO) as a primarily atmospheric disturbance whose initiation, maintenance, andpropagation characteristics may be flavored by surface turbulent fluxes that are modulated byseasurfacetemperature (SST) variations. The longerthansynoptictimescale of the MJO and itsimpact on a variety of highimpactglobal weather phenomena implies an opportunity to increaseglobal weather prediction skill if the MJO can be reliably predicted. Impediments to MJOpredictions include 1) poor predictions of whether a given convective event will propagate fromthe Indian Ocean to the West Pacific Ocean, where the global teleconnection response isstrongest; and 2) a lack of understanding of the processes that initiate MJO convection.The onset of MJO convection can be preceded by a variety of atmospheric precursorsignals whose individual expressions can vary from event to event, and can influence predictionskill. Once the MJO	42,301	2016
Colorado State University	CO	Collaborative Research: Assessing Oceanic Predictability Sources for MJO Propagation	The body of evidence from decades of work suggests a paradigm of the MaddenJulianOscillation (MJO) as a primarily atmospheric disturbance whose initiation, maintenance, andpropagation characteristics may be flavored by surface turbulent fluxes that are modulated byseasurfacetemperature (SST) variations. The longerthansynoptictimescale of the MJO and itsimpact on a variety of highimpactglobal weather phenomena implies an opportunity to increaseglobal weather prediction skill if the MJO can be reliably predicted. Impediments to MJOpredictions include 1) poor predictions of whether a given convective event will propagate fromthe Indian Ocean to the West Pacific Ocean, where the global teleconnection response isstrongest; and 2) a lack of understanding of the processes that initiate MJO convection.The onset of MJO convection can be preceded by a variety of atmospheric precursorsignals whose individual expressions can vary from event to event, and can influence predictionskill. Once the MJO	127,825	2016
The Regents of The University of Michigan	MI	Collaborative Research: Representing Calving and Iceberg Dynamics in Global Climate	The proposal describes a Climate Process Team focused on the representation of iceberg calving and subsequent transport of icebergs, freshwater, and tracers within global models. There are four components of the work. First, the Team will evaluate...	113,000	2016
The Trustees of Princeton University	NJ	Collaborative Research: Representing Calving and Iceberg Dynamics in Global Climate	The proposal describes a Climate Process Team focused on the representation of iceberg calving and subsequent transport of icebergs, freshwater, and tracers within global models. There are four components of the work. First, the Team will evaluate...	155,000	2016
University of Alaska Southeast	AK	Collaborative Research: Representing Calving and Iceberg Dynamics in Global Climate	The proposal describes a Climate Process Team focused on the representation of iceberg calving and subsequent transport of icebergs, freshwater, and tracers within global models. There are four components of the work. First, the Team will evaluate...	31,000	2016
University of Kansas Center for Research, Inc.	KS	Collaborative Research: Representing Calving and Iceberg Dynamics in Global Climate	The proposal describes a Climate Process Team focused on the representation of iceberg calving and subsequent transport of icebergs, freshwater, and tracers within global models. There are four components of the work. First, the Team will evaluate...	55,000	2016
Pennsylvania State University, The	PA	Collaborative Research: Representing Calving and Iceberg Dynamics in Global Climate	The proposal describes a Climate Process Team focused on the representation of iceberg calving and subsequent transport of icebergs, freshwater, and tracers within global models. There are four components of the work. First, the Team will evaluate...	75,000	2016
BATTELLE MEMORIAL INSTITUTE	WA	Competing Water Uses in the Face of Climate Change	In the Puget Sound region, climate change is altering the water cycle and water resourceconditions, and the most disruptive effects are linked to extreme events such as low summerstreamflow conditions and winter floods. Competing water uses will become increasinglyimportant in the face of extreme events, including competition for adequate stream flows forsustainable fish production, hydropower requirements, irrigation needs, and residential demands.Similarly, planning for extreme flooding events in coastal floodplains and estuaries will becomemore challenging with increased intensities of extreme rain events and shifts in run-off timing.Modeling tools are available to predict climate change impacts on water resources at the regionalscale, while water resources planning and response occurs at the local level. Additionally, modeloutputs and observation data are commonly in formats not readily accessible to water resourcesplanners and managers.To effectively include the extreme climate ev	149,615	2016
Consortium for Ocean Leadership, Inc.	WDC	Consortium for Ocean Leadership, Inc.	The Consortium for Ocean Leadership (COL) is a Washington, D.C.-based nonprofit organization that represents the leading ocean science and technology institutions - public and private, academia, aquaria, and industry. Our mission is to shape the future of ocean science and technology.	28,875	2016
The Trustees of Princeton University	NJ	Constraining Methane Leakage from Abandoned Oil and Gas Wells	We propose to expand our initial examination of AOL oil and gas wells to include more wells in the Marcellus Shale region and in the Denver- - Julesburg (DJ) Basin in Colorado. We wish to conduct instantaneous measurements of methane and collect and analyze (both gas chromatographic and isotopic analyses) methane fluxes and hydrocarbon leakage in order to characterize the thermogenic methane source separately from any biogenic contributions. Our objective is to collect sufficient data to permit a robust scaling up of our findings to a regional estimate of methane leakage from AOL wells in Pennsylvania and Colorado so that these emissions may be included in a greenhouse gas emission inventory. We wish to create a framework in which new measurements can be included to improve formation-, state- and US-scale methane emission estimates from AOL wells in methane emission inventories. We also wish to provide a baseline of leakage from AOL wells so that a later determination of whether new ex	199,991	2016

NOAA/OAR Climate Competetive Research

University Corporation for Atmospheric Research	CO	Cooperative Agreement for the NOAA Science Collaboration Program	The University Corporation for Atmospheric Research (UCAR)/Visiting Scientist Program (VSP) proposes to work in partnership with NOAA through a multi-year cooperative agreement. This partnership will contribute to the development of early career scientists and enhance collaborations between scientists and professionals in areas of mutual interest across the full spectrum of NOAA science programs. UCAR's Significant Opportunities in Atmospheric Research and Science (SOARS) program and UCAR's Societal Impacts Program (SIP) will contribute to this partnership by involving undergraduate and graduate student exposure and participation in NOAA-related science and by integrating social science into meteorological research and practice in comprehensive and sustained ways.	64,000	2016
University Corporation for Atmospheric Research	CO	Cooperative Agreement for the NOAA Science Collaboration Program	The University Corporation for Atmospheric Research (UCAR)/Visiting Scientist Program (VSP) proposes to work in partnership with NOAA through a multi-year cooperative agreement. This partnership will contribute to the development of early career scientists and enhance collaborations between scientists and professionals in areas of mutual interest across the full spectrum of NOAA science programs. UCAR's Significant Opportunities in Atmospheric Research and Science (SOARS) program and UCAR's Societal Impacts Program (SIP) will contribute to this partnership by involving undergraduate and graduate student exposure and participation in NOAA-related science and by integrating social science into meteorological research and practice in comprehensive and sustained ways.	1,896,000	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	24,781	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	110,643	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	466,440	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	1,438,179	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	477,143	2016

NOAA/OAR Climate Competetive Research

The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	321,066	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	37,241	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	1,107,673	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	254,286	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	98,095	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	1,239	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	23,857	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	16,053	2016

NOAA/OAR Climate Competetive Research

The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	1,862	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	55,384	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	5,532	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	28,227	2016
The Trustees of Princeton University	NJ	Cooperative Institute for Climate Science (CICS-P) at Princeton University	Climate competitive research to 1) Develop and improve models that simulate and aid the understanding of the present climate and Earth system, and that can be used to predict changes in the state of the climate and Earth system; (2) Data Assimilation - Develop capabilities to assimilate both physical and biogeochemical observations to produce an estimate of the current environmental state for use in Earth system modeling and the prediction of the future state of the climate; and (3) Earth System Modeling Applications - Use Earth system models to study the processes associated with long term climate change and variability, and to make predictions of the future state of the Earth system.	84,623	2016
REGENTS OF THE UNIVERSITY OF MICHIGAN	MI	Cooperative Institute for Limnology and Ecosystems Research (CILER) at the University of Michigan	CILER research focuses on five themes that aim to improve scientific understanding and the prediction of key physical, chemical and biological processes in order to facilitate the restoration, protection and management of Great Lakes natural resources.	10,252	2016
REGENTS OF THE UNIVERSITY OF MICHIGAN	MI	Cooperative Institute for Limnology and Ecosystems Research (CILER) at the University of Michigan	CILER research focuses on five themes that aim to improve scientific understanding and the prediction of key physical, chemical and biological processes in order to facilitate the restoration, protection and management of Great Lakes natural resources.	625	2016
Colorado State University	CO	Cooperative Institute for Research in the Atmosphere (CIRA) at Colorado State University	To serve as a nexus for multi-disciplinary cooperation among CI and NOAA research scientists, in the context of NOAA-specified research theme areas in satellite applications for weather/climate forecasting. Important bridging elements of the CI include the communication of research findings to the international scientific community, transition of applications and capabilities to NOAA operational users, education and training programs for operational user proficiency, outreach programs to K-12 education and the general public for environmental literacy, and understanding and quantifying the societal impacts of NOAA research.	8,194	2016
COLORADO STATE UNIVERSITY	CO	Cooperative Institute for Research in the Atmosphere (CIRA) at Colorado State University	To serve as a nexus for multi-disciplinary cooperation among CI and NOAA research scientists, in the context of NOAA-specified research theme areas in satellite applications for weather/climate forecasting. Important bridging elements of the CI include the communication of research findings to the international scientific community, transition of applications and capabilities to NOAA operational users, education and training programs for operational user proficiency, outreach programs to K-12 education and the general public for environmental literacy, and understanding and quantifying the societal impacts of NOAA research.	50,000	2016
University of Washington	WA	CPT to improve cloud and boundary layer processes in GFS/CFS	The proposal describes a broad effort to improve the simulated cloud and cloud-radiative climatology of the GFS. The effort will include both the incorporation of advanced parameterizations for boundary layer moist physics as well as targeted effo...	163,000	2016

NOAA/OAR Climate Competetive Research

University of Washington	WA	CPT to improve cloud and boundary layer processes in GFS/CFS	The proposal describes a broad effort to improve the simulated cloud and cloud-radiative climatology of the GFS. The effort will include both the incorporation of advanced parameterizations for boundary layer moist physics as well as targeted effo...	(163,000)	2016
University of Washington	WA	CPT to improve cloud and boundary layer processes in GFS/CFS	The proposal describes a broad effort to improve the simulated cloud and cloud-radiative climatology of the GFS. The effort will include both the incorporation of advanced parameterizations for boundary layer moist physics as well as targeted effo...	164,000	2016
DELTARES USA INC.	MD	Critical infrastructure and future flood resilience in South Florida: developing methods for direct and indirect flood impact assessment	It is widely acknowledged that coastal regions must become more flood resilient - meaning people and the economy are well-prepared to recover quickly from floods. South Florida increasingly experiences widespread damages, as well as nuisance and indirect impacts from flooding. Failure of critical infrastructure can cause cascading effects to other geographic areas and economic sectors than those directly affected. For example when roads are flooded, trucks cannot reach orange groves and an entire supply chain is disrupted. Also, traffic delays due to flooded roads have an indirect impact because people cannot get to work. Counties in South Florida are actively trying to gain a better understanding of these issues and are working to increase community resilience. To support decision-making on enhancing flood resilience, methods need to be improved. Current methods focus on direct flood impacts, but indirect impacts on the economic functioning of a region may be larger than direct damage	137,088	2016
Massachusetts Institute of Technology	MA	Deposition of Atmospheric Organic Carbon: New Constraints on the Reactive Carbon Budget	Here we propose a joint measurement-modeling project that aims to constrain the reactive organic carbon (and hence OA) budget of the atmosphere by focusing on wet deposition processes. This work will utilize samples from the National Atmospheric Deposition Program / National Trends Network (NADP/NTN), a longstanding nationwide network that focuses on the inorganic components of rainwater, but generally not organic species. Monthly samples from sites across the continental U.S. will be analyzed for the total amount of deposited organics and also for their carbon oxidation state, providing information about both the wet-deposition flux and the cômpetition between atmospheric deposition and oxidation. Analysis will be carried out using high-resolution electron impact mass spectrometry; samples will be introduced into the mass spectrometer using two different interfaces, allowing for the approximate distinction of organics from the particle phase with those from the gas phase.Model simulat	199,763	2016
UNIVERSITY OF MONTANA SYSTEM	MT	Design, decisions, and critical data for FIREX	To address critical unknowns in emissions from biomass burning, the PI will provide both a suite of measurements and assistance with the design and execution of the NOAA FIREX program. He will quantify a critical, foundational suite of ~20-30 trace gases in the FireLab stack and night-time smoke using advanced artifact-free optical remote sensing. This includes the major organic and inorganic emissions of both flaming and smoldering and C, H, N, S, O, and Cl species. The PI will quantify BC and BrC using advanced photoacoustic spectroscopy, which avoids filter-based artifacts, in the fire lab stack and also measure how these species evolve in well-characterized context in smog chambers and nighttime smoke. The BC and BrC instruments used here will be part of the first intercomparison of BC measurement techniques carried out in BB aerosol. PI Yokelson will provide service and timely intelligence to enhance the design and execution of all FIREX components, including the aircraft campaign	140,431	2016
The Regents of the University of Colorado	CO	Developing a 14C-based Fossil Fuel CO2 Emission Estimation Capability for "Carbon Tracker"	The goal of this project is to develop the tools necessary to use the information from the expanded 14C measurement programs within the context of the CarbonTracker assimilation and inversion framework in order to improve estimates of terrestrial ...	49,035	2016
UNIVERSITY OF MIAMI	FL	Developing a Real-Time Multi-Model Sub-Seasonal Predictive Capability	This proposal aims at improving the skill of operational sub-seasonal forecasts by developing a prototype multi-model sub-seasonal prediction system, based on ensemble forecasts from a number of institutions already involved in the seasonal NMME. Partners in the project are expected to provide a suitable set of re-forecasts (covering 17 years) as well as real-time forecasts (for 1 year) to NCEP/CPC. These data will also be available to the research community through the IRI Data Library, and contribute to the WWRP/WCRP S2S project. In addition to the data collection above, the project is going to provide: a baseline verification of sub-seasonal re-forecasts, focussing on sub-seasonal phenomena including MJO, blocking and large-scale teleconnection indices, as well as upper-ocean processes; an evaluation of multi-model vs individual model performance, and an optimization of the design of the multi-model system; a communication plan to ensure effective interactions between the core team	74,709	2016
Trustees Of Columbia University In The City Of New York	NY	Developing a Real-Time Multi-Model Sub-Seasonal Predictive Capability	This proposal aims at improving the skill of operational sub-seasonal forecasts by developing a prototype multi-model sub-seasonal prediction system, based on ensemble forecasts from a number of institutions already involved in the seasonal NMME. Partners in the project are expected to provide a suitable set of re-forecasts (covering 17 years) as well as real-time forecasts (for 1 year) to NCEP/CPC. These data will also be available to the research community through the IRI Data Library, and contribute to the WWRP/WCRP S2S project. In addition to the data collection above, the project is going to provide: a baseline verification of sub-seasonal re-forecasts, focussing on sub-seasonal phenomena including MJO, blocking and large-scale teleconnection indices, as well as upper-ocean processes; an evaluation of multi-model vs individual model performance, and an optimization of the design of the multi-model system; a communication plan to ensure effective interactions between the core team	185,000	2016

NOAA/OAR Climate Competetive Research

George Mason University	VA	Developing a Real-Time Multi-Model Sub-Seasonal Predictive Capability	This proposal aims at improving the skill of operational sub-seasonal forecasts by developing a prototype multi-model sub-seasonal prediction system, based on ensemble forecasts from a number of institutions already involved in the seasonal NMME. Partners in the project are expected to provide a suitable set of re-forecasts (covering 17 years) as well as real-time forecasts (for 1 year) to NCEP/CPC. These data will also be available to the research community through the IRI Data Library, and contribute to the WWRP/WCRP S2S project. In addition to the data collection above, the project is going to provide: a baseline verification of sub-seasonal re-forecasts, focussing on sub-seasonal phenomena including MJO, blocking and large-scale teleconnection indices, as well as upper-ocean processes; an evaluation of multi-model vs individual model performance, and an optimization of the design of the multi-model system; a communication plan to ensure effective interactions between the core team	119,137	2016
Florida International University	FL	Developing a Real-Time Multi-Model Sub-Seasonal Predictive Capability	This proposal aims at improving the skill of operational sub-seasonal forecasts by developing a prototype multi-model sub-seasonal prediction system, based on ensemble forecasts from a number of institutions already involved in the seasonal NMME. Partners in the project are expected to provide a suitable set of re-forecasts (covering 17 years) as well as real-time forecasts (for 1 year) to NCEP/CPC. These data will also be available to the research community through the IRI Data Library, and contribute to the WWRP/WCRP S2S project. In addition to the data collection above, the project is going to provide: a baseline verification of sub-seasonal re-forecasts, focussing on sub-seasonal phenomena including MJO, blocking and large-scale teleconnection indices, as well as upper-ocean processes; an evaluation of multi-model vs individual model performance, and an optimization of the design of the multi-model system; a communication plan to ensure effective interactions between the core team	20,000	2016
University Corporation for Atmospheric Research	CO	Development of a Framework for Process-Oriented Diagnosis of Global Models	The proposal would develop a coordinated software framework to enable sharing of diagnostic codes between NCAR and GFDL. The primary scientific emphasis is on process-oriented diagnostics related to tropical convection and its variability. Most of the proposed work is highly relevant to Area A Type 1 of the MAPP call, with the scientific components also intersecting with Area A Type 2. A core scientific focus of the proposed work is process-oriented diagnostics for mid tropospheric moisture and moist static energy in convective onset in the MJO. This emphasis on atmospheric fast physics could benefit both the climate and NWP communities. The proposed analysis of cloud populations using satellite observations and DYNAMO radar was found by the panel to be especially compelling.	142,174	2016
The Regents of the University of California, UCLA	CA	Development of a Framework for Process-Oriented Diagnosis of Global Models	The proposal would develop a coordinated software framework to enable sharing of diagnostic codes between NCAR and GFDL. The primary scientific emphasis is on process-oriented diagnostics related to tropical convection and its variability. Most of the proposed work is highly relevant to Area A Type 1 of the MAPP call, with the scientific components also intersecting with Area A Type 2. A core scientific focus of the proposed work is process-oriented diagnostics for mid tropospheric moisture and moist static energy in convective onset in the MJO. This emphasis on atmospheric fast physics could benefit both the climate and NWP communities. The proposed analysis of cloud populations using satellite observations and DYNAMO radar was found by the panel to be especially compelling.	70,570	2016
Colorado State University	CO	Development of a Framework for Process-Oriented Diagnosis of Global Models	The proposal would develop a coordinated software framework to enable sharing of diagnostic codes between NCAR and GFDL. The primary scientific emphasis is on process-oriented diagnostics related to tropical convection and its variability. Most of the proposed work is highly relevant to Area A Type 1 of the MAPP call, with the scientific components also intersecting with Area A Type 2. A core scientific focus of the proposed work is process-oriented diagnostics for mid tropospheric moisture and moist static energy in convective onset in the MJO. This emphasis on atmospheric fast physics could benefit both the climate and NWP communities. The proposed analysis of cloud populations using satellite observations and DYNAMO radar was found by the panel to be especially compelling.	81,903	2016
The Regents of the University of California, UCLA	CA	Development of a Monitoring and Prediction System for Flash Droughts over the United States	The proposal has a narrow focus to develop and deliver a targeted set of products regarding flash droughts: prototype real-time (1) monitoring, (2) subseasonal warning forecasts; and (3) subseasonal to multi-season watch forecasts. The target area is CONUS, and forecasts would use operational GEFS and CFSv2 products, as well as the NMME. Monitoring would be based on NLDAS. The lead PI has a previously developed version of the multi-land model monitoring that is not NLDAS-based, and both PIs have published definitions and analyses for two categories of flash droughts - those primarily triggered by heat and those triggered by (lack of) precipitation. The proposal expects that work would reach TRL7-8 by end of project.	15,120	2016

NOAA/OAR Climate Competetive Research

GULF OF MAINE RESEARCH INSTITUTE	ME	Development of an Online Climate and Fisheries Data Dashboard for Stakeholders in the Northeast Shelf Large Marine Ecosystem	Fisheries managers make decisions that shape the future of ecosystems and thecommunities that depend on them. These decisions are often made without reference toenvironmental conditions, or are made assuming that past conditions (physical conditions,productivity, and species distributions) will persist. The rapid changes experienced inthe Northeast Shelf Large Marine Ecosystem (NES LME), as well as the high degree of naturalvariability in this system, are prompting new discussions about how to incorporateenvironmental information into fisheries policy and management and into the industry.Through this work, the project team will facilitate access to fisheries and climate data forfisheries stakeholders in the Northeast through the creation of a dynamic data dashboard. Theprimary goal is to make complex climate-relevant data accessible and easy to understand. Wewill synthesize information on past, present, and future environmental conditions in the NESLME presented in the context of fishe	300,000	2016
Pacific Northwest National Laboratory	WA	Development of Decision Support Tools for Harmful Algal Bloom Monitoring in a Changing Climate using a Coupled Modeling Approach	In Puget Sound, Washington State, increasing occurrences of harmful algal blooms (HABs) of marine dinoflagellates in the genus Alexandrium severely threaten human health and the economic backbone of coastal communities - shellfish harvests. Since the 1950s, shellfish harvesting closures due to toxic Alexandrium blooms have increased in frequency, intensity, duration and geographic extent. This increase has been in part attributed to the 20th century warming trend in Puget Sound waters. With projected future changes in global and regional climate, the risk of human exposure to HABs and their toxins is expected increase even more. The Washington State Department of Health (WDOH) will be faced with the challenge of how to best allocate resources available for HAB toxin monitoring to protect the health of coastal communities inhabiting the counties bordering Puget Sound. This project will develop a valuable tool to provide decision support services to WDOH for allocating HAB toxin monitori	137,139	2016
University of Maryland, College Park	MD	Development of ensemble-based sea ice analysis and forecasting in the Climate Forecast System	The methodology for this work is clear and has been tested using the GODAS assimilation system. The team is well-qualified and positioned to complete the proposed research. There is good collaboration with NCEP and a support scientist at EMC will be supported 0.9 FTE, so the work will be completed and transitioned to NCEP (however EMC senior personnel are only committing a week/year to the project). There appears to be good communication between the different projects and the end product will be a great benefit to NCEP. The panel agreed that this is an important study and that even the studies proposed with the weakly coupled system alone will be a significant contribution. However, there was concern expressed about whether this proposed research can stand alone if the other proposals in this series are not supported (most notably the primary proposal to coordinate all the other individual efforts). This brought up the question as to whether this research is at a mature enough state to	11,000	2016
University of Maryland, College Park	MD	Development of Probalistic Drought Intensification Forecasts using the GOES-based Evaporative Stress Index	The proposed work would use satellite-derived maps of Evaporative Stress Index (ESI) and ensemble forecasts of wind, precipitation, and height anomalies from NMME to develop a drought early warning system operating on weekly to monthly timescales. ESI would be generated with the Atmosphere-Land Exchange Inverse (ALEXI) surface energy balance model using GOES thermal infrared imagery and NARR. A Rapid Change Index (RCI) product encapsulating the cumulative magnitude of ESI anomalies has also been developed. Refinements will be made to the RCI-based probabilities through combining drought early warning signals from multiple data sources, such as the ESI, Standardized Precipitation Index, and the soil moisture from the North American Land Data Assimilation System. Finally, weekly probabilistic drought intensification forecasts will be generated across the contiguous U.S. based on the ESI and ensemble NMME forecast output (temperature and rainfall). The drought forecast products would be	24,000	2016
University of Hawaii Systems	HI	Development of process-oriented metrics for ENSO-induced teleconnection over North America and U.S. Affiliated Pacific Islands in Climate models	The proposed work will provide a detailed assessment of models' ability in representing moist convective processes in the tropical Pacific, especially during the life-cycle of ENSO. Process-oriented diagnostics are proposed that will lead to the identification of the source of model errors and provide pathways for model improvement. Deliverables include objectively oriented and physically based metrics for climate models' performance in representing precipitation anomalies along the equatorial Pacific, a teleconnection over North America and the USAPI. The more specific goals are: (i) to perform process-oriented diagnostics, particularly related to moist convective processes on all available observations, a suite of reanalysis products, and in NMME-2 and 45 CMIP5 models, and (ii) to develop a set of metrics that will shed insight into model performance (or lack thereof) and provide pathways for model development.	98,000	2016

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The Trustees of Princeton University	NJ	Distribution of fugitive methane emissions in the Marcellus Shale	We propose to measure the distribution of fugitive methane (CH4) emissions in the Marcellus Shale from public roadways with a unique trace gas sensing mobile laboratory, quantify uncertainties in emissions estimates from mobile measurements using dedicatedmicrometeorological case studies and modeling, and identify how various individual well metrics (total production, days since well completion) link to the distribution of emissions. Fugitive CH4 missions from gas/oil operations have significant climate, air quality, and societal implications. There is an immediate need to understand the distribution of emitters in order to identify the most effective mitigation policies and problematic emitting segments within the production life cycle. The proposed efforts will quantify CH4 emissions from 1000 individual gas/oil facilities (pads, wells, and associated infrastructure such as compressor stations, storage facilities) operating within the Marcellus Shale. A novel, multi-gas (CH4, C2H6, N	207,712	2016
Research Foundation of State University of New York, The	NY	Diurnal Metrics for Evaluating GFDL and Other Climate Models	The proposal would develop diurnal metrics and establish linkages between the metrics and their controlling physical processes as seen in observations and reanalyses, so that modelers can use the metrics to evaluate and diagnose specific underlying processes simulated in their models. Physical linkages will be emphasized for surface pressure, daily maximum (Tmax) and minimum (Tmin) temperature, DTR, SH, and LH. Individual tasks include: 1) gather and compile sub-daily (hourly to 6-hourly) data from observations and other sources (Table 1), 2) analyze these data to improve our understanding of the physical processes behind the diurnal variations in various fields, 3) develop a new set of diurnal metrics and establish the link to their underlying physical processes, and 4) apply the new diurnal metrics to evaluate and diagnose model physics in the GFDL and other CMIP5 models. Table 2 in the proposal lays out potential metrics and linkages to physical processes.	143,192	2016
UNIVERSITIES SPACE RESEARCH ASSOCIATION	MD	Estimating the Subseasonal Forecast Skill in the NASA GEOS-5 System with a Focus on the Madden Julian Oscillation and the Land Surface Memory Feedback Processes	The PI team proposes to tune the NASA-GOESS model (e.g., adjusting the threshold minimum entrainment rate and model time step) for a better representation of the MJO and upgrade the model to include a dynamic phenology component (e.g., including the variations in the leafiness of the vegetation), and to conduct long-term sub-seasonal hindcasts and one-year real-time forecasts as a participant of the MME. Since this model has participated in the seasonal NMME experiment, the proposed study is a natural extension of the previous activity. The MJO skill in the NASA GEOS-5 is up to 15 days of lead time measured with anomaly correlation of 200-hPa velocity potential averaged between 20 degrees south and 20 degrees north. The GEOS-5 still has difficulty spontaneously generating the MJO in long free-running integrations. However, the model skill for two MJO events during YOTC is beyond 16-18 days with the bivariate correlation of WH indices above 0.7. The proposed tuning is well-supported by	153,000	2016
The Trustees of Columbia University in the City of New York	NY	Evaluating How Dry Deposition Influences Eastern U.S. Ozone, Aerosols, and Precursors Mean Contribution, Uncertainties, and Spatio-Temporal Variability from Weather, Regional Climate, and Land Use.	We propose to probe the role of dry deposition, including specific dry depositionpathways (stomatal versus non-stomatal) and variations with meteorology and land use, in shaping observed distributions of ozone and aerosols over the eastern United States, as well as day-to-day, seasonal, and year-to-year variability. We propose a new approach that involves implementing a mechanistic dry deposition scheme that varies with meteorology and biophysical controls into the NOAA GFDL AM3/LM3 model. Combining the new model configuration (AM3-DD) with observations - from the summer 2013 NOAA SENEX field campaign, earlier eastern U.S. field campaigns, and ground-based networks and field sites - provides an ideal test bed for process-oriented evaluation of the sensitivity of vertical distributions of ozone, aerosol, and their precursors to different representations of dry deposition. We propose to use AM3-DD to identify constraints on eastern U.S. ozone and aerosol distributions offered by aircraft	139,870	2016
Gulf of Maine Research Institute	ME	Evaluating social-ecological vulnerability and climate adaptation strategies for Northeast U. S. fishing communities	Climate change is affecting marine ecosystems, fish populations, and fisheries that depend on them. Marine waters of the Northeast Shelf have warmed rapidly over the past decade, and as a result, the impacts of climate variability and change are being felt acutely in this region. In the Northeast United States, the conversation around climate and fisheries is moving from a discussion of impacts on fish populations to a discussion of impacts on fisheries and fishing communities. Fishermen and fishing communities are already recognizing the need for new scientific information to understand vulnerabilities to climate variability and climate change and to identify adaptation options at local scales and within time frames relevant to decision-making. This project will advance the science needed to assess climate vulnerabilities for Northeast fishing communities and evaluate strategies to support adaptation to both climate variability and climate change. Our goal is to develop a social-ecot	908,630	2016
FLORIDA STATE UNIVERSITY, THE	FL	Evaluation and Diagnosis of the Atlantic Meridional Overturning Circulation 3D Structure in Climate Models	The proposal will develop a comprehensive analysis framework of the AMOC structure across the Atlantic to gauge the transport of heat/freshwater and water mass transformation as simulated by climate models. Much of the proposed research is highly relevant to Area A type 2 of the call.	54,155	2016
FLORIDA STATE UNIVERSITY, THE	FL	Evaluation and Diagnosis of the Atlantic Meridional Overturning Circulation 3D Structure in Climate Models	The proposal will develop a comprehensive analysis framework of the AMOC structure across the Atlantic to gauge the transport of heat/freshwater and water mass transformation as simulated by climate models. Much of the proposed research is highly relevant to Area A type 2 of the call.	54,156	2016

NOAA/OAR Climate Competetive Research

UNIVERSITY OF TOKYO, THE	NA	Evaluation of warm cloud microphysical processes in global climate models with multi-sensor satellite observations	The proposal will evaluate microphysical processes in warm liquid clouds using state -of- the -art A- train satellite observations, and then apply their process- based metrics to climate model evaluation and development. The goals are to: 1) develop observationally based metrics of warm rain microphysics key signatures using observations, 2) apply the metrics to climate models to identify biases in processes (e.g., autoconversion), and 3) propose improvements in the microphysical parameterizations to provide more reliable estimates of aerosol indirect forcing. The work leverages existing and mature cloud process evaluation diagnostics and uses them to influence two US climate modeling centers development processes (GFDL, NCAR).	46,717	2016
MASSACHUSETTS INSTITUTE OF TECHNOLOGY	MA	Exploring linkages between AMOC and ITCZ variability	The northern- -hemisphere troposphere is some 1-2C warmer than that of the southern hemisphere due to cross- -equatorial heat transport by ocean circulation, with the Atlantic Meridional Overturning Circulation (AMOC) playing the major role. One consequence of a warmer northern hemisphere is that precipitation maximizes at about 6N of the equator in the Intertropical Convergence Zone (ITCZ), facilitating a compensating southward heat transport by atmospheric circulation. The connection between inter- -hemispheric energy transport by AMOC and the ITCZ places AMOC at center- -stage in building predictability systems: if the AMOC and its associated cross- -equatorial energy transport has predictability on decadal timescales, then so may the ITCZ and its associated precipitation and temperature anomalies.This proposal would explore the efficacy of these ideas using observations and models and the likelihood that AMOC/AMO variability might be leveraged for predictability of ITCZ migrations.	376,702	2016
Regents of the University of California, The	CA	Extreme Moisture Transport (Atmospheric Rivers) into the Arctic and its Effect on Sea-Ice Concentration	Over recent decades the Arctic has warmed approximately twice as fast as the rest of the Northern Hemisphere. At the same time, Arctic sea-ice concentration has decreased rapidly, especially in September when sea ice in the Arctic reaches its lowest extent of the year. Interannual variability in the minimum sea ice extent is enormous, especially over the past decade that includes several years of record minimum coverage interspersed with other less extreme years. Satellite observations of sea ice concentrations go back to 1979.This vast interannual variability is mostly driven by extratropical atmospheric dynamical processes both directly and indirectly, and modulated by slower ocean processes. Wind represents an important forcing of sea ice distribution that qualifies as direct forcing. Thermodynamical consequences of extratropical dynamical variability such as changes to the radiative surface fluxes due to increased moisture in the Arctic can in turn lead to important feedback proces	223,721	2016
Regents of the University of California, The	CA	Extreme Moisture Transport (Atmospheric Rivers) into the Arctic and its Effect on Sea-Ice Concentration	Over recent decades the Arctic has warmed approximately twice as fast as the rest of the Northern Hemisphere. At the same time, Arctic sea-ice concentration has decreased rapidly, especially in September when sea ice in the Arctic reaches its lowest extent of the year. Interannual variability in the minimum sea ice extent is enormous, especially over the past decade that includes several years of record minimum coverage interspersed with other less extreme years. Satellite observations of sea ice concentrations go back to 1979.This vast interannual variability is mostly driven by extratropical atmospheric dynamical processes both directly and indirectly, and modulated by slower ocean processes. Wind represents an important forcing of sea ice distribution that qualifies as direct forcing. Thermodynamical consequences of extratropical dynamical variability such as changes to the radiative surface fluxes due to increased moisture in the Arctic can in turn lead to important feedback proces	(223,721)	2016
Regents of the University of California, The	CA	Extreme Moisture Transport (Atmospheric Rivers) into the Arctic and its Effect on Sea-Ice Concentration	Over recent decades the Arctic has warmed approximately twice as fast as the rest of the Northern Hemisphere. At the same time, Arctic sea-ice concentration has decreased rapidly, especially in September when sea ice in the Arctic reaches its lowest extent of the year. Interannual variability in the minimum sea ice extent is enormous, especially over the past decade that includes several years of record minimum coverage interspersed with other less extreme years. Satellite observations of sea ice concentrations go back to 1979.This vast interannual variability is mostly driven by extratropical atmospheric dynamical processes both directly and indirectly, and modulated by slower ocean processes. Wind represents an important forcing of sea ice distribution that qualifies as direct forcing. Thermodynamical consequences of extratropical dynamical variability such as changes to the radiative surface fluxes due to increased moisture in the Arctic can in turn lead to important feedback proces	223,721	2016
GEORGE MASON UNIVERSITY	VA	Fingerprints of AMOC Variations Derived From Machine Learning Methods	We propose to derive fingerprints of AMOC variability from long climate simulations and then apply these fingerprints to reconstruct the AMOC based on observations. We argue that if different climate models agree on certain relations, then these relations can be used with some confidence to produce new reconstructions of the AMOC. Conversely, if models disagree on these relations, then this research will raise questions about the scientific basis for observational reconstructions. The fingerprints will be derived using new machine learning methods that have proven ability to extract fingerprints from highdimensional model output that subsequently can be validated in observations. The sensitivity of fingerprints to the climate model from which they were derived will be quantified and used to validate models using available observations. The fingerprints will be constructed for forced and unforced variability separately and then combined to produce reconstructions of the AMOC. An optimiz	191,816	2016

NOAA/OAR Climate Competetive Research

REGENTS OF THE UNIVERSITY OF MINNESOTA	MN	Fingerprints of AMOC Variations Derived from Machine Learning Methods	We propose to derive fingerprints of AMOC variability from long climate simulations and then apply these fingerprints to reconstruct the AMOC based on observations. We argue that if different climate models agree on certain relations, then these relations can be used with some confidence to produce new reconstructions of the AMOC. Conversely, if models disagree on these relations, then this research will raise questions about the scientific basis for observational reconstructions. The fingerprints will be derived using new machine learning methods that have proven ability to extract fingerprints from highdimensional model output that subsequently can be validated in observations. The sensitivity of fingerprints to the climate model from which they were derived will be quantified and used to validate models using available observations. The fingerprints will be constructed for forced and unforced variability separately and then combined to produce reconstructions of the AMOC. An optimiz	13,989	2016
REGENTS OF THE UNIVERSITY OF CALIFORNIA, THE	CA	Fires In the Western US: Analyzing Emitted Speciated Organic Trace Gases and Aerosolsand their Atmospheric Chemical Transformations	The proposed research aims to elucidate the speciated chemical composition and transformationsof intermediate to low-volatility organic compounds emitted from BB. The FIREX study is beingplanned with a major focus on closing the gap in knowledge by providing unprecedentedemission profiling coupled with plume tracking measurements and modeling to predict BBOAlevels. Once these air masses are photochemically aged for hours to days, detailed chemicalanalyses including a full suite of organic aerosol source and product markers are needed tounderstand mass closure between modeled and measured organic aerosol. Through powerful chemical separation and identification techniques and by obtaining unprecedented hourly time resolution for chemically speciated measurements of oxygenated intermediate and semi-volatile organic compounds and particle phase organic compounds during FIREX, the PIs expect to make substantial progress in understanding the formation and transformation of wildfire impacts o	107,312	2016
Colorado State University	CO	Following Emissions from Non-Traditional Oil and Gas Development Through their Impact on Tropospheric Ozone	We request support from the Atmospheric Chemistry, Carbon Cycle, and Climate (AC4)Program to investigate how emissions from oil and gas extraction change O3 production at the local, continental and global scale. The proposed work tackles these questions:1. What are characteristic O3 production rates and efficiencies in air masses influenced by emissions from oil and gas production?2. To what extent have emissions from oil and gas production impacted the extent of NOx versus NMVOC limited O3 production?3. Through which chemical pathways do emissions from oil and gas production propagatemost efficiently to global O3 production?4. How do emissions from this sector affect radiative forcing through perturbations totropospheric O3, methane, and remote aerosol formation?In summer 2015 and spring 2016, we will quantify O3 production rates, sensitivity to emissions and aspects of reactive nitrogen partitioning at the NOAA BAO tower in northeastern Colorado.Significant oil and gas extraction abu	146,631	2016
Colorado State University	CO	Forecasting North Pacific Blocking and Atmospheric River Probabilities: Sensitivity to Model Physics and the MJO	Atmospheric rivers (ARs) are intense synoptic-scale plumes of tropospheric water vapor thatcan lead to extreme precipitation and flooding when they make landfall. These features causeextreme flooding events not only along the west coast of the contiguous United States (CONUS),but also in Canada and Alaska. The ability to forecast ARs would provide society with advancedknowledge of their extreme impacts. Recent work by the our team demonstrates an inverserelationship between winter-time ARs hitting Alaska and CONUS, driven by the presence of ablocking anticyclone over the east Pacific that acts to divert the ARs away from CONUS andinto the Gulf of Alaska. The potential exists to forecast the probabilities of North Pacificblocking and AR occurrence through knowledge of the Madden-Julian oscillation (MJO).Specifically, additional recent work by our team demonstrates that the pattern of blockingleading to an increase in Alaskan ARs (and subsequent decrease in CONUS ARs) is driven, atleast	104,005	2016
UNIVERSITY OF CONNECTICUT	CT	From precipitation thresholds identification to planning: Helping communities plan and adapt to future extreme events	The combination of more frequent and severe precipitation and sea-level rise pose an enormousrisk to coastal New England and to coastal Connecticut in particular. The amount of precipitationfalling in the most intense 1% of precipitation events has already increased by 70 - 240% in theNortheast since the 1950s. These changes have already worsened flood frequency and continuedincreases will likely exacerbate flooding. In addition to heavy precipitation, over the last 100years, coastal New England has experienced 12 inches of sea level rise (SLR) with moreaccelerated rising projected to occur by the end of the 21st Century. Taken together, morefrequent and intense storms, flooding, and SLR are and will continue to wreak havoc onstormwater management. In light of these impacts, coastal communities need climateinformation and assistance in identifying and planning for decision tipping points within thecontext of ongoing comprehensive planning efforts. Communities have laid the groundwork f	147,409	2016

NOAA/OAR Climate Competetive Research

The Regents of the University of Colorado	CO	Ground-based measurements to study fossil fuels production operations emissions of methane and non-methane hydrocarbons and their atmospheric impacts	Abstract:To help address the gap between bottom-up and top-down methane emissions estimatesat the regional scale, we propose to deploy in-situ instrumentation and discrete airsampling on-board the NOAA GMD Mobile Laboratory in coordination with plannedairborne campaigns in three unconventional fossil fuel producing basins: 1/ the Denver-Julesburg shale and tight sand oil and gas producing Basin, CO, 2/ the San Juan coal bedmethane and coal producing Basin, NM and 3/ a shale dry gas region of the Marcellus inNE Pennsylvania.We will conduct intensive road surveys to map CH4 and 13CH4 throughout each region.We will identify significant methane emissions from fossil fuel operations and from nonfossil-fuel related sources and collect discrete air sampling in individual sources plumesand in background air to document their chemical signatures. Our proposed work willfully take advantage of a new GC-MS system built at NOAA GMD, which will extendamong other species the analysis to more alkanes	186,876	2016
UNIVERSITY OF MIAMI	FL	High-resolution tracer study of AMOC pathways and timescales	Redistribution of heat, freshwater and carbon anomalies by the Atlantic Meridional Overturning Circulation (AMOC) plays an important role in regulating climate variability. The knowledge of pathways and timescales associated with AMOC is required for understanding linkages different parts of the global ocean and for interpretation of the observed variability. The progress in this direction is challenging because of the important modulations of these linkages by mesoscale eddy-induced mixing. The challenge comes in large part from the enormous computing costs of running extended numerical simulations and high spatial resolutions. Instead, vast majority of numerical studies of AMOC rely on coarse-resolution simulations, which parameterize all important small-scale processes. Despite significant advances in these parameterization schemes, their fidelity is challenging to establish, which results in biases and uncertainties in studies on the role of AMOC in climate and its variability. Thi	242,618	2016
I.M. SYSTEMS GROUP, INC.	MD	High-resolution Tracer Study of AMOC Pathways and Timescales	Redistribution of heat, freshwater and carbon anomalies by the Atlantic Meridional Overturning Circulation (AMOC) plays an important role in regulating climate variability. The knowledge of pathways and timescales associated with AMOC is required for understanding linkages different parts of the global ocean and for interpretation of the observed variability. The progress in this direction is challenging because of the important modulations of these linkages by mesoscale eddy-induced mixing. The challenge comes in large part from the enormous computing costs of running extended numerical simulations and high spatial resolutions. Instead, vast majority of numerical studies of AMOC rely on coarse-resolution simulations, which parameterize all important small-scale processes. Despite significant advances in these parameterization schemes, their fidelity is challenging to establish, which results in biases and uncertainties in studies on the role of AMOC in climate and its variability. Thi	53,910	2016
Ohio State University, The	OH	Identifying, Quantifying, and Constraining Uncertainties Associated with Black Carbon Emissions during Open Biomass Burning	This project will provide a comprehensive and systematic inter-comparison of BCinstrumentation. Open biomass burning is a major source of atmospheric BC, but largeuncertainties exist in BC emission factors (EFBC). These uncertainties can be grouped into twocategories: instrument differences and natural variability. Instrument differences are related tovarious techniques used to measure BC, a generic term that can represents one of three distinctoperationally-defined quantities: equivalent BC (eBC), refractory BC (rBC), and elementalcarbon (EC); instrument differences are especially problematic when EFBC representing eBC, rBC,and/or EC are compiled for emission inventories due to potential inconsistencies amongtechniques. While similar inter-comparison studies have been conducted in the past, it is unclearwhether they can resolve EFBC uncertainty; they have either been conducted in controlledenvironments using simple systems of laboratory-generated BC or if the studies did investigateBC	160,964	2016
Handix Scientific LLC	CO	Identifying, Quantifying, and Constraining Uncertainties Associated with Black Carbon Emissions during Open Biomass Burning	This project will provide a comprehensive and systematic inter-comparison of BC instrumentation. Open biomass burning is a major source of atmospheric BC, but large uncertainties exist in BC emission factors (EFBC). These uncertainties can be grouped into two categories: instrument differences and natural variability. Instrument differences are related to various techniques used to measure BC, a generic term that can represents one of three distinct operationally-defined quantities: equivalent BC (eBC), refractory BC (rBC), and elemental carbon (EC); instrument differences are especially problematic when EFBC representing eBC, rBC, and/or EC are compiled for emission inventories due to potential inconsistencies among techniques. While similar inter-comparison studies have been conducted in the past, it is unclear whether they can resolve EFBC uncertainty; they have either been conducted in controlled environments using simple systems of laboratory-generated BC or if the studies did	30,196	2016

NOAA/OAR Climate Competetive Research

Nova Southeastern University	FL	Improvement of MJO Simulation in NCEP Coupled Forecast System: Upper Ocean and Air-Sea Coupled Processes	Accurate simulation and prediction of the Madden-Julian Oscillation (MJO) is one of the major challenges for climate modeling and operational weather forecasts. The MJO in the NCEP Coupled Forecast System (CFS) is too weak and propagates too slowly, particularly during its initiation and evolution over the Indian Ocean. With the objective to advance our understanding of the MJO initiation processes and improve MJO prediction, DYNAMO international field campaign provides a substantial amount of oceanic and atmospheric in-situ data. In the last few years, the DYNAMO data have been used to identify important oceanic, atmospheric, and air-sea coupled processes in the MJO initiation and propagation. A primary goal of this proposed study is to advance MJO simulation and prediction in NOAA CFS by improving the representation of the air-sea flux and upper-ocean vertical mixing. The DYNAMO data and the outcome from our previous DYNAMO projects will be maximally utilized for the improvement of M	89,988	2016
Woods Hole Oceanographic Institution	MA	Improvement of MJO Simulation in NCEP Coupled Forecast System: Upper Ocean and Air-Sea Coupled Processes	Accurate simulation and prediction of the Madden-Julian Oscillation (MJO) is one of the major challenges for climate modeling and operational weather forecasts. The MJO in the NCEP Coupled Forecast System (CFS) is too weak and propagates too slowly, particularly during its initiation and evolution over the Indian Ocean. With the objective to advance our understanding of the MJO initiation processes and improve MJO prediction, DYNAMO international field campaign provides a substantial amount of oceanic and atmospheric in-situ data. In the last few years, the DYNAMO data have been used to identify important oceanic, atmospheric, and air-sea coupled processes in the MJO initiation and propagation. A primary goal of this proposed study is to advance MJO simulation and prediction in NOAA CFS by improving the representation of the air-sea flux and upper-ocean vertical mixing. The DYNAMO data and the outcome from our previous DYNAMO projects will be maximally utilized for the improvement of M	60,000	2016
Texas A&M University - Corpus Christi	TX	Improvement of MJO simulation in NCEP Coupled Forecast System: Upper ocean and air-sea coupled processes	Accurate simulation and prediction of the Madden-Julian Oscillation (MJO) is one of the major challenges for climate modeling and operational weather forecasts. The MJO in the NCEP Coupled Forecast System (CFS) is too weak and propagates too slowly, particularly during its initiation and evolution over the Indian Ocean. With the objective to advance our understanding of the MJO initiation processes and improve MJO prediction, DYNAMO international field campaign provides a substantial amount of oceanic and atmospheric in-situ data. In the last few years, the DYNAMO data have been used to identify important oceanic, atmospheric, and air-sea coupled processes in the MJO initiation and propagation. A primary goal of this proposed study is to advance MJO simulation and prediction in NOAA CFS by improving the representation of the air-sea flux and upper-ocean vertical mixing. The DYNAMO data and the outcome from our previous DYNAMO projects will be maximally utilized for the improvement of M	202,809	2016
University of Hawaii Systems	HI	Improvement of MJO simulation in NCEP Coupled Forecast System: Upper ocean and air-sea coupled processes	Accurate simulation and prediction of the Madden-Julian Oscillation (MJO) is one of the major challenges for climate modeling and operational weather forecasts. The MJO in the NCEP Coupled Forecast System (CFS) is too weak and propagates too slowly, particularly during its initiation and evolution over the Indian Ocean. With the objective to advance our understanding of the MJO initiation processes and improve MJO prediction, DYNAMO international field campaign provides a substantial amount of oceanic and atmospheric in-situ data. In the last few years, the DYNAMO data have been used to identify important oceanic, atmospheric, and air-sea coupled processes in the MJO initiation and propagation. A primary goal of this proposed study is to advance MJO simulation and prediction in NOAA CFS by improving the representation of the air-sea flux and upper-ocean vertical mixing. The DYNAMO data and the outcome from our previous DYNAMO projects will be maximally utilized for the improvement of M	60,000	2016
The Regents of the University of Colorado	CO	Improving emissions, predictions and impact assessments of biomass burning smoke and dynamic air quality using FIREX observations, ground networks and Satellite Data	The PIs propose to participate in the FIREX field experiment and undertake complementary research activities to study the following science questions: What are the size distributions and absorptive properties of aerosol emissions from differentbiomass fuels, and how do these climate-relevant properties evolve to impact actinic flux bothdirectly and via interactions with clouds and other meteorological factors? What is the diurnal and nocturnal magnitude and spatiotemporal variability of aerosol andtrace-gas emissions from different types of biomass burning? How can airborne measurements be optimally deployed to address the above questions, givenexisting observation networks (ground based and satellite), and to what extent do differentdata sources and inversion techniques reduce uncertainties in smoke emissions estimates? What are the broader impacts of fires on air quality and climate, compared to anthropogenicsources, and how do constraints from FIREX refine these estimates?These	46,000	2016

NOAA/OAR Climate Competetive Research

The University of Iowa	IA	Improving emissions, predictions and impact assessments of biomass burning smoke and dynamic air quality using FIREX observations, ground networks and satellite data	The PIs propose to participate in the FIREX field experiment and undertake complementary research activities to study the following science questions: What are the size distributions and absorptive properties of aerosol emissions from differentbiomass fuels, and how do these climate-relevant properties evolve to impact actinic flux bothdirectly and via interactions with clouds and other meteorological factors? What is the diurnal and nocturnal magnitude and spatiotemporal variability of aerosol andtrace-gas emissions from different types of biomass burning? How can airborne measurements be optimally deployed to address the above questions, givenexisting observation networks (ground based and satellite), and to what extent do differentdata sources and inversion techniques reduce uncertainties in smoke emissions estimates? What are the broader impacts of fires on air quality and climate, compared to anthropogenicsources, and how do constraints from FIREX refine these estimates?These	37,500	2016
University of Washington	WA	Improving Initialization of Arctic Sea Ice in NCEP???s Climate Forecast System for Advancing Long-Range Predictions	Prediction and predictability of Arctic sea ice on different time scales has received increasing attention recently. While ?perfect-model? studies have shown that Arctic sea ice extent is predictable out to eight months or longer, diagnoses of the forecasts from the current dynamical operational climate models show that the useful prediction skill for inter-annual sea ice anomalies is lost beyond the first 2-3 months. Similarly, the analysis of the outlook collected by the NOAA SEARCH (Study of Environmental Arctic Change) indicates that predicting the variability of the September Arctic sea ice is difficult even from July initial conditions, and further, there exists a substantial spread among the forecasts from different prediction systems. Understanding the causes of the forecast errors and the discrepancy between the potential predictability and actual skill, and enhancing the skill of prediction of Arctic sea ice to at par with predictability estimates is a highly desirable goal t	44,263	2016
Research Foundation of State University of New York, The	NY	Improving seasonal predictability and prediction of Arctic sea ice and associated feedbacks on mid- and high-latitude climate in CFSv2	Recent changes in the extent, thickness, and properties of Arctic sea ice have captured attention and posed significant challenges to a wide range of stakeholders. There is a rising demand for sea ice prediction at seasonal-to-interannual timescales. Sea ice prediction is challenging in the context of climate prediction models. Relative to the NCEP Climate Forecast System version 1 (CFSv1), one of the most important developments in the CFSv2 is the incorporation of a sea ice model component. Our evaluations suggested that although the CFSv2 captures the observed seasonal cycle and trend of Arctic sea ice to some extent, large errors exist. The most significant biases are sea ice too thick with interannual variability that is too weak. A major cause of the bias is lack of observations of sea ice thickness over broad areas of the Arctic that would aid in the forecast procedures. Another potential cause of the bias is that assumptions of parameterizations of sea ice optical properties cur	100,054	2016
George Mason University	VA	Improving subseasonal to seasonal forecast skill of North American precipitation and surface air temperature using multi-model strategy	This proposal responds to the 2016 solicitation for CPO?s Modeling, Analysis, Prediction and Projection (MAPP) program Competition 2: ?Research to Advance Prediction of Subseasonal to Seasonal Phenomena?. The proposed project focuses on ?improving methodologies for global to regional-scale analysis, predictions, and projections? and ?developing integrated assessment and prediction capabilities relevant to decision makers based on climate analyses, predictions, and projections? in the MAPP?s primary objectives.A large number of forecasts from a suite of models are routinely provided by the Subseasonal toSeasonal (S2S) Prediction Project and the North American Multi-Model Ensemble (NMME) Project. To develop a reliable and timely climate product from these datasets, we propose a new methodology to assess individual model?s forecast skill, generating statistical weights based on the skill of member model forecasts of slowly-varying surface states, and using these weights to produce an opti	130,997	2016
NOAA National Weather Service	MD	Improving sub-seasonal to seasonal prediction	Funds research projects directly supporting new and improved long-range weather and climate products and services provided by the National Weather Service.	2,476,406	2016
NOAA National Weather Service	MD	Improving sub-seasonal to seasonal prediction	Funds research projects directly supporting new and improved long-range weather and climate products and services provided by the National Weather Service.	50,000	2016
University of Massachusetts	MA	Improving the environment while protecting coasts: A holistic accounting of ecosystem services of Green Infrastructure and Natural and Nature-Based Featurest(NNBF)in an urbanized coastal environment	Overview: As a result of Superstorm Sandy, which devastated many coastal communities in NewYork and New Jersey in October 2012, a great deal of thought, effort and treasury has beenexpended in rebuilding communities in a more sustainable and resilient manner. The projectteam has worked with residents in the environmental justice community of East Boston,Massachusetts since 2008 and have accomplished the following: 1) educated residents on thepotential impacts of coastal flooding due to climate change and, 2) presented feasible adaptationstrategies to stakeholders in the community to make them aware of the types of adaptationstrategies and to learn about their possible acceptance by the community, and 3) brought togetherresidents with infrastructure agencies to develop adaptation strategies that protect bothstakeholders. The research proposed herein will leverage our deep understanding of how coastalflooding due to climate change will affect East Boston and the relationships that have b	279,000	2016

NOAA/OAR Climate Competetive Research

RAND CORPORATION, THE	CA	Incorporating Interactive Visions and Bioeconomic Values of Ecosystem Services into Climate Adaptation: An Example from Jamaica Bay, Brooklyn / Queens, New York City	Natural capital, and the ecosystem services (ES) that they provide, have traditionally been undervalued in the coastal zone, as recent events like Hurricanes Sandy and Katrina demonstrate. Incorporating the benefits that nature gives in practical day-to-day decision-making requires enhancing adoption of rapid and easy-to-use tools that allow policymakers and the public to see and value ecosystem services in the monetary terms that drive American land use and management decisions. Meanwhile, those ES benefits and their values are evolving as the climate changes, and as society considers costly interventions to enhance the resilience of our coasts to future events.This project is designed to be a role-model for ES valuation in decision-making for coastalstorm flood adaptation in one of the most important coastal zones in the US: Jamaica Bay (J-Bay) in New York City. We propose to leverage prior research and new and existingpartnerships to develop an improved ES valuation framework for Na	250,000	2016
AMERICAN PLANNING ASSOCIATION	IL	Incorporating Local Climate Science to Help Communities Plan for Climate Extremes	ProblemWhile more and better climate data are becoming more readily available to community planners,there is still a disconnect between data availability and how that climate data is applied toplanning and decision making. Barriers include insufficient resources, staff, and funding toprepare plans to address issues arising from climate change. This problem has some uniquefeatures in the Great Lakes region related to urban and riverine flooding in connection with morefrequent high-precipitation events.RationaleTesting approaches to overcoming these barriers within the Chicago metropolitan area affordsthe opportunity to identify a range of community types. The partnership assembled for thisproposal includes: the American Planning Association, the Chicago Metropolitan Agency forPlanning, and both the Illinois State Climatologist and Illinois/Indiana Sea Grant & MidwestRegional Climate Center extension climatologist, in a combined effort to overcome these barriersto planning and implem	149,999	2016
BOARD OF REGENTS OF THE UNIVERSITY OF NEBRASKA	NE	Increasing the capacity for municipal climate adaptation planning in the lower Missouri River Basin states	Increasingly, city leaders are considering climate data and information as a guide for theircomprehensive plans. Although there are a great deal of climate and climate change resourcesavailable, there unfortunately is an inadequate supply of climatologists who can analyze andinterpret the past, present, and future climate of each individual city in a manner that engagesurban planners and city officials. This disconnect makes it challenging for municipalities toaccess and adequately interpret climate data to make effective, comprehensive plans for resourcemanagement. Over the past year, staff members from the High Plains Regional Climate Centerhave worked alongside city managers, planners, and other climatologists to understand climateinformation needs for different municipality departments in select cities in the Midwest andGreat Plains. Preliminary results showed that each location had unique concerns regarding avariety of issues ranging from heat and cold waves and their impacts on h	97,889	2016
Rutgers, The State University of New Jersey - New Brunswick	NJ	Indicators of habitat change affecting three key commercial species of the U.S. Northeast Shelf: A design to facilitate proactive management in the face of climate change	Statement of the Problem and Rationale: The productivity and/or distributions of many living marine resources (LMRs) within the U.S. Northeast Shelf (U.S. NES) have been changing in concert with warming ocean temperatures. However, most operational models used for the assessment of LMRs to inform fisheries management assume that the effects of the environment on distribution, population productivity, and natural mortality are implicit or fixed in space and time. As a result, assessment projections of stock size used for developing fisheries management regulations assume past ecosystem conditions will be sustained in the future. The few studies that have incorporated climate change into LMR models have used empirical relationships between the environment, distribution, and abundance derived from field studies. These studies are in essence environmental correlations but are limited in their description of ecological relationships because: 1) Abundance and distribution patterns in the fie	69,632	2016
University of Delaware	DE	Indicators of habitat change affecting three key commercial species of the U.S. Northeast Shelf: A design to facilitate proactive management in the face of climate change	Statement of the Problem and Rationale: The productivity and/or distributions of many living marine resources (LMRs) within the U.S. Northeast Shelf (U.S. NES) have been changing in concert with warming ocean temperatures. However, most operational models used for the assessment of LMRs to inform fisheries management assume that the effects of the environment on distribution, population productivity, and natural mortality are implicit or fixed in space and time. As a result, assessment projections of stock size used for developing fisheries management regulations assume past ecosystem conditions will be sustained in the future. The few studies that have incorporated climate change into LMR models have used empirical relationships between the environment, distribution, and abundance derived from field studies. These studies are in essence environmental correlations but are limited in their description of ecological relationships because: 1) Abundance and distribution patterns in the fie	74,403	2016

NOAA/OAR Climate Competetive Research

RISTROPH, ELIZAVETA BARRETT	AK	Indigenous Climate Change Adaptation: Policies and Processes that Help and Hinder Alaska Native Villages Address Flooding, Erosion, Species Shifts, and Disasters	Alaska Native Village face severe risks from climate change due to melting of ice andtundra, flooding, shoreline erosion and loss of traditional flora and fauna. These indigenouscommunities have strong connection to their traditional lands and waters yet many are facedwith the need to relocate. Studies have shown that most ANVs do not have adaptation plansand appear to be unprepared to address climate impacts. Further, while lack of funding is anissue, the other aspect of the problem is the difficulty for tribes in navigating Western legaland institutional frameworks. This research is intended to fill a research need that has notbeen well addressed by examining what ANV governments can do, how they can coordinatewith higher levels of government, and what laws and institutions may need to bereconsidered to help them successfully adapt to climate change.The PI will use a variety of methods to accomplish this goal including conducting qualitativecontent analysis of interviews with selecte	40,000	2016
Massachusetts Institute of Technology	MA	Influence of atmospheric ageing on fire-derived carbonaceous particles: laboratory studies and modeling in support of FIREX	The PIs propose a joint measurement-modeling project that aims to better constrain the climateand air quality impacts of North American wildfires, via the detailed examination of the evolvingoptical, physical, and chemical properties of fire-derived particulate matter (PM). Such PMincludes absorbing species such as black carbon (BC) and brown carbon (BrC), the properties ofwhich are likely to change dramatically in the atmosphere subsequent to emission. However,such effects are poorly understood at present, representing major limitations in our ability topredict the amounts, properties, and impacts of wildfire emissions. Thus, the PIs will carry out anextensive series of laboratory experiments involving the detailed measurement of the changes tofire-derived PM with atmospheric oxidation. Central to this work is the implementation of a newsuite of state-of-the-science analytical techniques, providing highly detailed measurements of thechemistry, hygroscopicity, and optics of fine partic	138,731	2016
University of California, Davis	CA	Influence of atomospheric aging on fire-derived carbonaceous particles: laboratory studies and modeling in support of FIREX	The PIs propose a joint measurement-modeling project that aims to better constrain the climateand air quality impacts of North American wildfires, via the detailed examination of the evolvingoptical, physical, and chemical properties of fire-derived particulate matter (PM). Such PMincludes absorbing species such as black carbon (BC) and brown carbon (BrC), the properties ofwhich are likely to change dramatically in the atmosphere subsequent to emission. However,such effects are poorly understood at present, representing major limitations in our ability topredict the amounts, properties, and impacts of wildfire emissions. Thus, the PIs will carry out anextensive series of laboratory experiments involving the detailed measurement of the changes tofire-derived PM with atmospheric oxidation. Central to this work is the implementation of a newsuite of state-of-the-science analytical techniques, providing highly detailed measurements of thechemistry, hygroscopicity, and optics of fine partic	87,341	2016
The Regents of the University of Colorado	CO	Inorganic Aerosol Precursor Emissions During SENEX: A Modeling Analysis Constrained by Surface, Aircraft, and Satellite Data	Abstract: The primary objective of this work is to quantify emissions of the inorganicaerosol precursors NOx, SO2, and NH3 during the 2013 NOAA Southeast Nexus (SENEX)campaign using a combination of data gathered by the NOAA WP-3 research aircraft, satellite retrievals from the NASA Ozone Monitoring Instrument (OMI), the joint NOAA, NASA, and DOD Cross-track Infrared Sounder (CrIS), and the NASA Tropospheric Emission Spectrometer (TES), and surface observations from the Southern Oxidant and Aerosol Study (SOAS). Ammonium nitrate and ammonium sulfate aerosols formed from NH3, NOx, and SO2 can harm human health and air quality, as well as alter the climate directly through the scattering and absorption of radiation and indirectly by changing cloud albedo, cloud lifetime, and precipitation. In addition, anthropogenic emissions of NOx, SO2, and NH3 may indirectly impact the formation of secondary organic aerosol (SOA) from natural precursors such as isoprene and terpenes. Uncertainty in th	28,274	2016
Atmospheric and Environmental Research, Inc.	MA	Inorganic Aerosol Precursor Emissions During SENEX: A Modeling AnalysisConstrained by Aircraft, Satellite, and Surface Data	Abstract: The primary objective of this work is to quantify emissions of the inorganic aerosol precursors NOx, SO2, and NH3 during the 2013 NOAA Southeast Nexus (SENEX)campaign using a combination of data gathered by the NOAA WP-3 research aircraft, satellite retrievals from the NASA Ozone Monitoring Instrument (OMI), the joint NOAA, NASA, and DOD Cross-track Infrared Sounder (CrIS), and the NASA Tropospheric Emission Spectrometer (TES), and surface observations from the Southern Oxidant and Aerosol Study (SOAS). Ammonium nitrate and ammonium sulfate aerosols formed from NH3, NOx, and SO2 can harm human health and air quality, as well as alter the climate directly through the scattering and absorption of radiation and indirectly by changing cloud albedo, cloud lifetime, and precipitation. In addition, anthropogenic emissions of NOx, SO2, and NH3 may indirectly impact the formation of secondary organic aerosol (SOA) from natural precursors such as isoprene and terpenes. Uncertainty in t	104,090	2016

NOAA/OAR Climate Competetive Research

The Regents of the University of California, San Diego	CA	Interplay of marine layer clouds and heat waves along the California coast: Impacts on human health	The health of California residents and visitors is most vulnerable to heat waves along the highly populated and poorly acclimated coast. Heat wave activity is on the rise and is projected to increase in the future, particularly at the coast. The presence or absence of marine layer clouds (MLC) makes an essential difference to whether a heat wave impacts human health along the coast. A persistent MLC cover, most prominent during the peak of summer, contributes to the lack of coastal acclimation to heat. Some inland heat waves are associated with a stronger and more extensive marine layer, while others are not. The absence of MLC aggravates coastal heat impacts. We aim to quantify and clarify the statistical relationships and physics that control this MLC response and improve the understanding of heat waves and their impacts in California, particularly along the coast. We will define heat waves as health-impactful events a priori by using hospitalizations data alongside temperature. We	145,398	2016
The Regents of the University of California	CA	Investigating the Nighttime Chemistry of Biomass Burning Emissions	The nighttime chemistry of biomass burning (BB) plumes has the potential to stronglyinfluence air quality but is completely unknown. As part of the Fire Influence on Regional andGlobal Environments Experiment (FIREX), the PIs propose a multi-investigator collaboration toelucidate the nighttime gas- and particle-phase chemistry in BB plumes. They hypothesize suchchemistry is driven by as yet unexplored reactions between nocturnal oxidants (e.g., ozone (O3),nitrate radical (NO3), and dinitrogen pentoxide (N2O5)), with smoldering emissions (e.g.,terpenes, oxygenated aromatics, and particulate matter (PM)). To address the hypothesis andprovide critical insight into nighttime BB plume chemistry, the PIs will apply the followingadvanced analytical techniques, in close coordination with other FIREX investigators: 1) twodimensional gas chromatography with time-of-flight mass spectrometry (GC GC-TOFMS) forcharacterization of gaseous emissions and initial transformation products of non-methane o	185,042	2016
University of Oklahoma	OK	Investigating the Underlying Mechanisms and Predictability of the MJO - NAM Linkage in the NMME Phase-2 Models	Skillful weather predictions with 10- to 30-day lead times for the Northern Hemisphere(NH) extratropics remain a major challenge for the forecast community. Skillful predictions ofextratropical NH subseasonal weather ultimately depend on knowledge of the position and strengthof the polar jet stream, commonly represented by the Northern Annular Mode (NAM). Avenuesforward to narrowing the subseasonal-to-seasonal (S2S) prediction gap with respect to the NAMseek to exploit interactions of intraseasonal modes of climate variability with the NAM. One suchmode is the Madden-Julian Oscillation (MJO), the leading mode of subseasonal variabiliry in thetropics. Another source of extended predictability for the NH extratropics is the polar stratosphere,whereby the state of the polar vortex exerts a downward influence on the tropospheric jet streamand thereby alter weather patterns and the tropospheric waveguide. Whether or not thisstratospheric influence can influence MJO-related teleconnections r	60,322	2016
Colorado State University	CO	Investigating the Underlying Mechanisms and Predictability of the MJO ??? NAM Linkage in the NMME Phase-2 Models	Skillful weather predictions with 10- to 30-day lead times for the Northern Hemisphere(NH) extratropics remain a major challenge for the forecast community. Skillful predictions ofextratropical NH subseasonal weather ultimately depend on knowledge of the position and strengthof the polar jet stream, commonly represented by the Northern Annular Mode (NAM). Avenuesforward to narrowing the subseasonal-to-seasonal (S2S) prediction gap with respect to the NAMseek to exploit interactions of intraseasonal modes of climate variability with the NAM. One suchmode is the Madden-Julian Oscillation (MJO), the leading mode of subseasonal variability in thetropics. Another source of extended predictability for the NH extratropics is the polar stratosphere,whereby the state of the polar vortex exerts a downward influence on the tropospheric jet streamand thereby alter weather patterns and the tropospheric waveguide. Whether or not thisstratospheric influence can influence MJO-related teleconnections r	21,173	2016
Texas A&M University	TX	Investigation of the Effects of Oceanic Mesoscale Eddies on the Midlatitude Storm Tracks and Their Predictability	A recent analysis of the THORPEX Interactive Grand Ensemble (TIGGE) showed that whilethe operational global ensemble forecast systems of the world's leading numerical weatherprediction centers were efficient, in general, in capturing the uncertainty dynamics associatedwith the high-frequency (synoptic scale) transients, they all predicted the slowly varying largescalecomponent of the flow with a systematic error whose magnitude increased with the forecasttime. Such a systematic error poses a major obstacle to extending skillful forecasting into thesubseasonal to seasonal (S2S) forecast range.The fact that the different ensemble forecast systems, which use different models and are alsogenerated differently, all fail in the same general fashion, suggests that there may be one or moreimportant dynamical processes that are not accounted for in the current forecast models. Ourgoal is to investigate the possibility that ocean mesoscale eddy-atmosphere (OME-A) feedbackfrom the ocean to the at	133,606	2016
The Trustees of Columbia University in the City of New York	NY	IRAP: Integrating Climate Information and Decision Processes for Regional Climate Resilience	Under this project entitled "IRAP: Integrating Climate Information for Decision Processes for Regional Climate Resilience", the PIs will address three regions vulnerable to climate change and variability: the Caribbean, the Indo-Gangetic Plain, an...	227,093	2016
The Trustees of Columbia University in the City of New York	NY	IRAP: Integrating Climate Information and Decision Processes for Regional Climate Resilience	Under this project entitled "IRAP: Integrating Climate Information for Decision Processes for Regional Climate Resilience", the PIs will address three regions vulnerable to climate change and variability: the Caribbean, the Indo-Gangetic Plain, an...	967,330	2016

NOAA/OAR Climate Competetive Research

The University of Chicago	IL	Kelp Forests: Their dynamics, Services and Fate in a Changing Climate	Kelp forests are key natural features worldwide that have significant ecosystem effects on thechemistry, biology and physical features of the coastal zone. Though carbon and nitrogen uptakeby kelp forests could ameliorate increasing anthropogenic levels of both, we know little aboutclimate drivers of kelp abundance and the function of kelp in situ. Our research plan has threeobjectives:I. Characterize the dynamics of kelp forests in coastal Washington State, includingcorrelates with key ocean climate drivers such as the Pacific Decadal Oscillation, NorthPacific Gyre Oscillation, sea surface temperature, and upwelling,II. Describe the ecosystem services that kelp forests provide including habitat for livingmarine resources, users of blue carbon, sites of nutrient uptake and recycling, andproducers at the base of the food webIII. Use our understanding from I. and II. to make predictions about the future fate of kelpforests, recognizing that kelp fitness is a generally a positive function	99,999	2016
University of Massachusetts, Dartmouth	MA	Kelp forests: their services, valuation and fate in a changing climate	Kelp forests are key natural features worldwide that have significant ecosystem effects on thechemistry, biology and physical features of the coastal zone. Though carbon and nitrogen uptakeby kelp forests could ameliorate increasing anthropogenic levels of both, we know little aboutclimate drivers of kelp abundance and the function of kelp in situ. Our research plan has threeobjectives:I. Characterize the dynamics of kelp forests in coastal Washington State, includingcorrelates with key ocean climate drivers such as the Pacific Decadal Oscillation, NorthPacific Gyre Oscillation, sea surface temperature, and upwelling,II. Describe the ecosystem services that kelp forests provide including habitat for livingmarine resources, users of blue carbon, sites of nutrient uptake and recycling, andproducers at the base of the food webIII. Use our understanding from I. and II. to make predictions about the future fate of kelpforests, recognizing that kelp fitness is a generally a positive function	30,000	2016
Clark University	MA	Linking Coastal Adaptation Portfolios to Tidal Marsh Resilience and Sustainable Ecosystem Service Values: Transferable Guidance for Decisions under Uncertainty	Introduction & Rationale: Tidal marshes are one of the most common natural and nature-basedfeatures (NNBF) used for coastal adaptation, and are frequently promoted for their ability to supportcoastal resilience and ecosystem services. However, fully functional, permanent marshes cannotsimply be built on the coast. Marsh resilience depends on the complex interplay of natural dynamicsand human actions. Among the most critical of these actions, the preservation of marsh transgression (or upland migration) zones is often necessary to ensure marsh resilience; the effect of these zones depends on uncertain sea level rise (SLR) and natural dynamics which determine how, when and where marshes migrate. Different types of transgression zones (e.g., different elevations/locations) perform differently depending on uncertain factors such as future SLR. Marshes with different attributes/locations also provide different ecosystem service values. These uncertainties and dynamics imply that diversi	139,441	2016
Trustees Of Columbia University In The City Of New York	NY	Madden Julian Oscillation - the Maritime Continent barrier and seamless verification	The Madden Julian Oscillation (MJO) is of central importance in subseasonal to seasonalforecasts but remains difficult to predict. An outstanding problem is that models have difficultysimulating or predicting the propagation of the MJO across the Maritime Continent. Thisdeficiency results in a prediction barrier. Overcoming this barrier is a challenge because itsprecise cause or causes are unknown. Proposed causes include poor representation of the diurnalcycle, biases in mean climate and failure to capture precursor signals. Our project seeks toimprove both understanding and prediction of the MJO, focusing on the relation of the MJO tothe Maritime Continent. We propose a systematic analysis of forecast and reforecast ensemblesfrom the Seasonal-to-Subseasonal (S2S) prediction project dataset. Success in forecasting MJOpropagation across the Maritime Continent varies between different runs in each ensemble aswell as across models. Relating forecast success, as well as MJO characteristic	162,937	2016
Carnegie Mellon University	PA	Measurement of Methane Emissions and Leakage from Natural Gas Extraction and Processing Facilities in Appalachia, the Rockies, and the Gulf Coast	We propose to quantify facility-level emissions of methane, oxides of nitrogen (NOx), andselect volatile organic compounds (VOCs) from wells, compressor stations, processing plants, and other types of facilities in the Denver-Julesburg and Uintah basins in Colorado/Utah and the Barnett shale in Texas using dual-tracer-flux ratio techniques and upwind, offsite tracer release. In this method, known quantities of two tracer gases (e.g. nitrous oxide, acetylene) are released upwind of a natural gas site, typically from a public road, and a mobile laboratory monitors the concentrations of the tracers and target analytes downwind of the facility using a suite of realtime, laser-based instrumentation. The technique allows quantification of the facility-level emission rate without use of an inverse model. By the releasing the tracers upwind of the site,the measurements can be made without participation (or even knowledge) of the site operator.To augment this dataset and in recognition of publi	200,000	2016

NOAA/OAR Climate Competetive Research

Carnegie Mellon University	PA	Measurement of Methane Emissions and Leakage from Natural Gas Extraction and Processing Facilities in Appalachia, the Rockies, and the Gulf Coast	We propose to quantify facility-level emissions of methane, oxides of nitrogen (NOx), andselect volatile organic compounds (VOCs) from wells, compressor stations, processing plants, and other types of facilities in the Denver-Julesburg and Uintah basins in Colorado/Utah and the Barnett shale in Texas using dual-tracer-flux ratio techniques and upwind, offsite tracer release. In this method, known quantities of two tracer gases (e.g. nitrous oxide, acetylene) are released upwind of a natural gas site, typically from a public road, and a mobile laboratory monitors the concentrations of the tracers and target analytes downwind of the facility using a suite of realtime, laser-based instrumentation. The technique allows quantification of the facility-level emission rate without use of an inverse model. By the releasing the tracers upwind of the site,the measurements can be made without participation (or even knowledge) of the site operator.To augment this dataset and in recognition of publi	(200,000)	2016
Carnegie Mellon University	PA	Measurement of Methane Emissions and Leakage from Natural Gas Extraction and Processing Facilities in Appalachia, the Rockies, and the Gulf Coast	We propose to quantify facility-level emissions of methane, oxides of nitrogen (NOx), andselect volatile organic compounds (VOCs) from wells, compressor stations, processing plants, and other types of facilities in the Denver-Julesburg and Uintah basins in Colorado/Utah and the Barnett shale in Texas using dual-tracer-flux ratio techniques and upwind, offsite tracer release. In this method, known quantities of two tracer gases (e.g. nitrous oxide, acetylene) are released upwind of a natural gas site, typically from a public road, and a mobile laboratory monitors the concentrations of the tracers and target analytes downwind of the facility using a suite of realtime, laser-based instrumentation. The technique allows quantification of the facility-level emission rate without use of an inverse model. By the releasing the tracers upwind of the site,the measurements can be made without participation (or even knowledge) of the site operator.To augment this dataset and in recognition of publi	200,000	2016
The Regents of the University of Colorado	CO	Megacities Carbon Project: Assessing the Impact of Policy and Management Decisions on the Los Angeles Urban Dome of CO2 and CH4	The overall goal of the project is to improve the scientific understanding of localized, high-flux elements of the carbon cycle associated with the significant spatial and temporal variability in the carbon exchange of urban landscapes and to support efforts by local stakeholders to evaluate actions intended to stabilize urban greenhouse gas emissions.	77,549	2016
RFCUNY - City College	NY	Metrics for general circulation model biases in extratropical cyclone clouds and precipitation: evaluating their skill and identifying processes to be improved.	The proposal would create a set of process-oriented metrics for extratropical cyclones. The metrics look at a variety of scales (planetary, synoptic, and frontal) and are designed to separate the influence of large-scale and cyclone-scale dynamics. The metrics will enable evaluation of a model's ability to: 1) reproduce atmospheric conditions within storms and 2) predict the clouds and precipitation within storms. Both numerical code for the metrics analysis and data for the reference metrics will be made available through the NOAA-CREST website.	118,978	2016
THE RESEARCH FOUNDATION OF STATE UNIVERSITY OF NEW YORK	NY	National Sea Grant Program	Knauss Fellowship	56,500	2016
University Corporation for Atmospheric Research	CO	NMME sub-seasonal to seasonal climate products for hydrology and water management	The proposed research aims at transferring and improving NMME products for hydrological applications. The team proposes to create bias-corrected spatially- and temporally-aggregated precipitation and temperature products over HUC units. These products will be made available through a portal for end-users and more specific the hydrological community and operational hydrological centers. The panel finds that the proposal is strong in terms of the advisory board and network that has been established as well as the connection the team wants to make between science and end-users. The proposal is very practical and could result in a potential benefit for the (operational) hydrological community. The proposal looks to be low risk and the final product could be rewarding for end-users that get a solid product that is easy to use and doesn't require a lot of pre-processing.	70,909	2016
The Regents of the University of Colorado	CO	NMME Sub-seasonal to Seasonal Climate Products for Hydrology and Water Management	The proposed research aims at transferring and improving NMME products for hydrological applications. The team proposes to create bias-corrected spatially- and temporally-aggregated precipitation and temperature products over HUC units. These products will be made available through a portal for end-users and more specific the hydrological community and operational hydrological centers. The panel finds that the proposal is strong in terms of the advisory board and network that has been established as well as the connection the team wants to make between science and end-users. The proposal is very practical and could result in a potential benefit for the (operational) hydrological community. The proposal looks to be low risk and the final product could be rewarding for end-users that get a solid product that is easy to use and doesn't require a lot of pre-processing.	7,938	2016
Board of Trustees, Southern Illinois University Carbondale	IL	North American Heat Wave Predictability: Assessing the Role of Land Surface Initialization on S2S and NMME Model Forecasts	initialization and land-atmosphere interactions influence subseasonal to seasonal (S2S)predictability of extreme heat and heat waves over North America. Accurate forecasting ofextreme heat events, particularly on S2S timescales, is important for public health preparation asvulnerability to extreme heat has increased over time. Soil moisture anomalies, through theircontrol on the partitioning of sensible and latent heat fluxes, are linked to temperature extremes.Dry soils limit evapotranspiration and can establish and perpetuate extreme heat events throughatmospheric heat accumulation (e.g., Miralles et al. 2014). Therefore it is not surprisingantecedent soil moisture deficits are found to correspond strongly with extreme temperatures inmost regions of the world. Recent studies have demonstrated large spread in model forecasts andsimulation of heat wave events over Europe and North America. Significant inter-modelvariability is purported to be a potential consequence of different bounda	52,283	2016

NOAA/OAR Climate Competetive Research

George Mason University	VA	North American Heat Wave Predictability: Assessing the Role of Land Surface Initialization on S2S and NMME Model Forecasts	This research addresses the critical need to improve our understanding of how land surfaceinitialization and land-atmosphere interactions influence subseasonal to seasonal (S2S)predictability of extreme heat and heat waves over North America. Accurate forecasting ofextreme heat events, particularly on S2S timescales, is important for public health preparation asvulnerability to extreme heat has increased over time. Soil moisture anomalies, through theircontrol on the partitioning of sensible and latent heat fluxes, are linked to temperature extremes.Dry soils limit evapotranspiration and can establish and perpetuate extreme heat events throughatmospheric heat accumulation. Therefore it is not surprisingantecedent soil moisture deficits are found to correspond strongly with extreme temperatures inmost regions of the world. Recent studies have demonstrated large spread in model forecasts andsimulation of heat wave events over Europe and North America. Significant inter-modelvariability i	115,192	2016
The Regents of the University of California, UCLA	CA	Objective Monitoring and Prediction System for Drought Classification over the Continental United States	Currently, a weakness in systems like NLDAS is the ability to classify droughts into categories. This project aims to (1) find an objective scheme for drawing boundaries between the D0-D4 classes, based on multiple drought indices derived from NLDAS output. A climatological distribution of the indices would be calculated and the boundaries for the classification would be based on percentiles from the distribution. The classification system would (2) be tested on NLDAS and evaluated by comparing with the USDM monitoring. An experimental forecast product would (3) be developed using NMME and (4) different predictability questions would be addressed (section 2.2 in the proposal). Finally, the forecast system would be evaluated and sources of errors will be analysed.	65,000	2016
Colorado State University	CO	Observational constraints on the mechanisms that control size- and chemistry-resolved aerosol fluxes over a Colorado forest	We propose to make at least four separate 6-week measurements to investigate mechanisms controlling aerosol fluxes over four seasons at Manitou Experimental Forest in Colorado. We will measure fluxes of (a) size-resolved particles (60-600 nm, ultra high sensitivity aerosol spectrometer) and (b) gas- and particle-phase organic and select inorganic species (bulk submicron aerosol, high resolution time-of-flight chemical ionization mass spectrometer with acetate reagent ion chemistry with alternating gas- and particle-phase inlets). We will use the chemical content of precipitation to estimate wet deposition of gaseous plus particulate organic carbon. We will combine our measurements to create a flux budget for aerosols describing the relevant importance of controlling mechanisms. In particular, we will determine: (1) Seasonal variation in accumulation mode aerosol dry deposition rates over a temperate forest, and the potential importance of this sink on aerosol lifetime, (2) The role of	121,772	2016
JOHNS HOPKINS UNIVERSITY, THE	MD	Oceanographic controls on Arctic sea ice and its future evolution	The annual cycle of sea ice in the Arctic and marginal ice zones is strongly affected by the flux of heat from the ocean to sea ice. This flux is mediated by a number of processes:1. During the summer, solar radiation can penetrate below the seasonal mixed layer. This is mediated by colored dissolved organic material, whose concentration is thought to be increasing in the Arctic, and by the presence of clear ice-melt layers. Neither of these processes is well-represented in the current generation of GFDL coupled climate models.2. During the winter, this heat can be returned to the mixed layer by mixing, and additional heat is added from Atlantic waters entering the Arctic. The ease with which this occurs depends on the amount of freshwater stored in the mixed layer and the depth to which this water is mixed. Understanding the evolution of freshwater anomalies within the Arctic may therefore be important for predicting the future of Arctic sea ice.3. Once it reaches the mixed layer, the	204,396	2016
University of North Carolina, Chapel Hill	NC	Organic Nitrogen in Atmospheric Aerosols: Concentrations, Chemical Composition, and Properties	The goal of the project is to determine the identities, amounts, and key properties of Particular Organic Nitrogen (PON) in organic aerosol, over a wide geographical and temporal range. Coverage of such a range will be achieved by analyzing previo...	43,750	2016
Massachusetts Institute of Technology	MA	Organic Nitrogen in Atmospheric Aerosols: Concentrations, Chemical Composition, and Properties	The goal of the project is to determine the identities, amounts, and key properties of Particular Organic Nitrogen (PON) in organic aerosol, over a wide geographical and temporal range. Coverage of such a range will be achieved by analyzing previo...	43,750	2016
Research Foundation of State University of New York, The	NY	Precursor Conditions to Onset and Breakdown of Agricultural Drought over the United States Corn Belt Region	The project aims at identifying weather conditions leading to onset and termination of agricultural drought in the Corn Belt region. It would use statistical analysis designed to establish links between a modeled crop growth index and weather variables. An advanced crop growth model would be used, as well as advanced statistical analysis tools. First the project would collect necessary observations to force the crop model. Then the crop model would be run to create a 60-year-long index on which drought onsets and terminations will be calculated. Then precursors of onsets and terminations would be identified through time-EOF and cluster analysis. The same index would be calculated using reforecasts in order to identify if the models are able to capture the precursors.	75,000	2016

NOAA/OAR Climate Competetive Research

George Mason University	VA	Predictability and Prediction of Climate from Days to Decades	This is the NOAA component of a proposal to support the Center for Ocean-Land-Atmosphere Studies (COLA) at George Mason University (GMU). The proposal has been invited by the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA). The goal of this work is to characterize and quantify the predictability and realizable skill in predicting Earth's climate variability from time scales of days to decades. COLA's prior line of research, which has helped establish a scientific basis for intraseasonal to interannual (ISI) predictability in a changing climate and fostered the transition of climate predictability research results to operational use, will be continued and expanded. Further effort will be devoted to establishing a scientific basis for decadal prediction. The proposed work will expand beyond previous efforts to also include a rigorous multi-scale evaluation of the physical processes	29,441	2016
University of Utah, The	UT	Predicting CO2 Emissions Associated With Urban Development in the Western U.S	The goal of the project is to, through a coordinated set of observational and modeling approaches, incorporate a mechanistic understanding of carbon emissions into a land use/planning model that will help researchers, policy makers, and the general public evaluate the carbon implications of land use choices in Western US.	258,156	2016
University of Wisconsin System	WI	Prediction, Sensitivity, and Dynamics of Subseasonal To Seasonal Phenomena Diagnosed Through Linear Inverse Models, Their Adjoints, and Numerical Weather Prediction Models	Subseasonal to seasonal (S2S) predictability faces a unique set of forecast challengesrelated to initialization, parameterization, and development of model bias around whichthe forecast state must evolve. Furthermore, a wide range of phenomena exist on S2Stimescales that require realistic evolution of the forecast state over a wide range ofgeographical regions and physical processes (e.g. tropical intraseasonal variability, lowfrequencymid-latitude wave dynamics, and downward propagation from thestratosphere), which presents a major challenge for numerical weather prediction (NWP)models that aim to forecast out to S2S time scales. Additionally, targeted forecasts ofdifferent specified extreme events (e.g. blocking, heat waves, cold snaps) may beassociated with very different sensitivities to any of these processes. A generalframework is needed for analyzing and evaluating the role of initial conditions, modelphysics, and development of model bias, in S2S predictability of specific extr	117,594	2016
University of Washington	WA	Process Oriented Diagnostics of Tropical Cyclones in Climate Models	This proposal covers an important area of climate research. It demonstrates a good and deep understanding of the interplay between convection and dynamics in various stages of TC development. The PI team proposed a suite of process-based diagnostics for simulations of TC, with a view toward better understanding of TC and climate relationship using CMIP5, NASA GISS, GFDL, and INGV-CMCC (Italy) GCM.	20,505	2016
Trustees Of Columbia University In The City Of New York	NY	Process Oriented Diagnostics of Tropical Cyclones in Climate Models	This proposal covers an important area of climate research. It demonstrates a good and deep understanding of the interplay between convection and dynamics in various stages of TC development. The PI team proposed a suite of process-based diagnostics for simulations of TC, with a view toward better understanding of TC and climate relationship using CMIP5, NASA GISS, GFDL, and INGV-CMCC (Italy) GCM.	129,356	2016
The Trustees of Princeton University	NJ	Process-orientated metrics of land surface-atmospheric interactions for diagnosing coupled model simulations of land surface hydro-meteorological extremes	The proposed work is a diagnostic analysis of land-atmosphere coupling that will develop a suite of process-based metrics to diagnose the coupling and feedbacks between the land and the atmosphere. Four specific objective are listed: (i) quantifying the variability of surface climate, hydrology, and extremes; (ii) investigating the processes that govern the occurrence and development of droughts and heat waves; (iii) developing and testing metrics that describe the processes governing land-atmosphere interactions and drought/heat wave covariability; and (iv) evaluating the CMIP5 coupled model simulations with these metrics. Much of the proposal is focused on the final two objectives.	141,373	2016
The Regents of the University of California, UCLA	CA	Process-oriented Diagnosis and Metrics Development for the Madden-Julian Oscillation Based on Climate Simulations	The proposal would continue exploration of processes determined to be important for realistic simulation of the MJO, including feedbacks between moisture and convection, cloud-induced radiative heating and convection, and convection and its induced circulation. By building upon process-oriented diagnostics, the intent is to construct process-oriented metrics that relate to performance-based measures. Much of the proposed research is highly relevant to area A of the call, metrics for climate and Earth system model development, as a type 2 Proposal.	136,805	2016
University of Massachusetts	MA	Quantification of gas and aerosol characteristics from North American fires: emis	The goal of the project is to deploy the Aerodyne Mobile Laboratory (AML) as part of the NOAA AC4 Program FIREX project to address several knowledge gaps related to the impact of BB on air quality and climate. The AML will participate in two planned studies at the USFS Fire Sciences Laboratory and will be deployed over a wide geographical range to sample BB plumes as part of the field intensive portion of the FIREX project in direct coordination with other ground and aircraft sampling platforms (e.g., the NOAA P3). The AML platform provides a range of sampling strategies, such as rapid deployment to new fires for emissions characterization, fixed site sampling in downwind locations for studying atmospheric evolution of the plumes, stationary sampling as an expanded laboratory space for USFS Fire Sciences Laboratory experiments, and mapping of plume-affected urban areas for health-related exposure. Project goals are closely aligned with the goals of the NOAA FIREX project and with NOAA'	36,982	2016

NOAA/OAR Climate Competetive Research

Aerodyne Research, Inc.	MA	Quantification of gas and aerosol characteristics from North American fires: emissions,evolution and exposure	The goal of the project is to deploy the Aerodyne Mobile Laboratory (AML) as part of the NOAA AC4 Program FIREX project to address several knowledge gaps related to the impact of BB on air quality and climate. The AML will participate in two planned studies at the USFS Fire Sciences Laboratory and will be deployed over a wide geographical range to sample BB plumes as part of the field intensive portion of the FIREX project in direct coordination with other ground and aircraft sampling platforms (e.g., the NOAA P3). The AML platform provides a range of sampling strategies, such as rapid deployment to new fires for emissions characterization, fixed site sampling in downwind locations for studying atmospheric evolution of the plumes, stationary sampling as an expanded laboratory space for USFS Fire Sciences Laboratory experiments, and mapping of plume-affected urban areas for health-related exposure. Project goals are closely aligned with the goals of the NOAA FIREX project and with NOAA'	162,881	2016
Trustees of Boston University	MA	Quantifying carbon signatures across urban-to-rural gradients: Advancing the capacity for monitoring, reporting, and verification through observations, models, and remote sensing	The goal of the project is to address uncertainties and knowledge gaps in the carbon cycle of densely populated areas by developing a model-data framework for prediction and assessment of CO2 fluxes in the Boston Metro region. The measurement component is built around an advanced network of surface CO2 observations, 14CO2 campaigns, ecological and biogeochemical measurements, and remote sensing of total column CO2 from space and from the ground. The model component integrates sub-models describing natural and human sources and sinks of CO2 (fossil fuel emissions, ecosystems fluxes, and land cover dynamics) with a high-resolution atmospheric transport model. The model-data framework will obtain optimal CO2 fluxes for the urban-to-rural domain by inverse modeling, allowing us to quantitatively characterize the spatial and temporal variations in CO2 component fluxes and net CO2 exchange with strong constraints from observed data.	165,646	2016
President and Fellows of Harvard College	MA	Quantifying carbon signatures across urban-to-rural gradients: Advancing the capacity for monitoring, reporting, and verification through observations, models, and remote sensing	The goal of the project is to address uncertainties and knowledge gaps in the carbon cycle of densely populated areas by developing a model-data framework for prediction and assessment of CO2 fluxes in the Boston Metro region. The measurement component is built around an advanced network of surface CO2 observations, 14CO2 campaigns, ecological and biogeochemical measurements, and remote sensing of total column CO2 from space and from the ground. The model component integrates sub-models describing natural and human sources and sinks of CO2 (fossil fuel emissions, ecosystems fluxes, and land cover dynamics) with a high-resolution atmospheric transport model. The model-data framework will obtain optimal CO2 fluxes for the urban-to-rural domain by inverse modeling, allowing us to quantitatively characterize the spatial and temporal variations in CO2 component fluxes and net CO2 exchange with strong constraints from observed data.	65,936	2016
Atmospheric and Environmental Research, Inc.	MA	Quantifying carbon signatures across urban-to-rural gradients: Advancing the capacity for monitoring, reporting, and verification through observations, models, and remote sensing	The goal of the project is to address uncertainties and knowledge gaps in the carbon cycle of densely populated areas by developing a model-data framework for prediction and assessment of CO2 fluxes in the Boston Metro region. The measurement component is built around an advanced network of surface CO2 observations, 14CO2 campaigns, ecological and biogeochemical measurements, and remote sensing of total column CO2 from space and from the ground. The model component integrates sub-models describing natural and human sources and sinks of CO2 (fossil fuel emissions, ecosystems fluxes, and land cover dynamics) with a high-resolution atmospheric transport model. The model-data framework will obtain optimal CO2 fluxes for the urban-to-rural domain by inverse modeling, allowing us to quantitatively characterize the spatial and temporal variations in CO2 component fluxes and net CO2 exchange with strong constraints from observed data.	29,889	2016
The Rector and Visitors of the University of Virginia	VA	Quantifying observational variability and inverse model biases of planetary boundary layer depths and their impact on the calculation of carbon fluxes in CarbonTracker.	This goals of this project are 1) to evaluate the performance of atmospheric transport models that drive global carbon inverse models in their simulation of Planetary Boundary Layer (PBL) depths, 2) to improve the representation of PBL depths in t...	66,285	2016
Atmospheric and Environmental Research, Inc.	MA	Reactive nitrogen biogeochemical cycling in the GFDL Earth System Models: Advancing understanding of atmosphere-land interactions under changing climate and land	The goal of the project is to improve the representation of the formation, radiative properties, internal mixing, and heterogeneous sources and sinks of nitrate aerosol, to be incorporated into a new version of the GFDL atmospheric model, AM3N. In the land model, we plan to represent Nr loss through denitrification in soils under anoxic conditions, including an explicit treatment of microbial processes. Runoff of Nr and cycling in rivers will be represented globally. The model will use improved scenarios of historical and future land management practices. We propose to improve the characterization of the Nr emissions and deposition through online coupling between the atmosphere and land components of the GFDL ESM. Speciated Nr emissions (NH3, NO, N2O) from unmanaged ecosystems, managed agricultural lands, and biomass burning will be represented. Wet and dry deposition fluxes of Nr species from the atmosphere will be provided as sources to the land model. The proposal will leverage and	10,000	2016

NOAA/OAR Climate Competetive Research

The Regents of The University of Michigan	MI	Reactive nitrogen biogeochemical cycling in the GFDL Earth System Models: Advancing understanding of atmosphere-land interactions under changing climate and land use	The goal of the project is to improve the representation of the formation, radiative properties, internal mixing, and heterogeneous sources and sinks of nitrate aerosol, to be incorporated into a new version of the GFDL atmospheric model, AM3N. In the land model, we plan to represent Nr loss through denitrification in soils under anoxic conditions, including an explicit treatment of microbialprocesses. Runoff of Nr and cycling in rivers will be represented globally. The model will useimproved scenarios of historical and future land management practices. We propose to improvethe characterization of the Nr emissions and deposition through online coupling between theatmosphere and land components of the GFDL ESM. Speciated Nr emissions (NH3, NO, N2O)from unmanaged ecosystems, managed agricultural lands, and biomass burning will berepresented. Wet and dry deposition fluxes of Nr species from the atmosphere will be providedas sources to the land model.The project will leverage and extend on	33,000	2016
The Governing Council of the University of Toronto	NA	Reactive nitrogen biogeochemical cycling in the GFDL Earth System Models: Advancing Understanding of the atmosphere-land Interactions under changing climate and land use	The goal of the project is to improve the representation of the formation, radiative properties, internal mixing, and heterogeneous sources and sinks of nitrate aerosol, to be incorporated into a new version of the GFDL atmospheric model, AM3N. In the land model, we plan to represent Nr loss through denitrification in soils under anoxic conditions, including an explicit treatment of microbial processes. Runoff of Nr and cycling in rivers will be represented globally. The model will use improved scenarios of historical and future land management practices. The project will improve the characterization of the Nr emissions and deposition through online coupling between the atmosphere and land components of the GFDL ESM. Speciated Nr emissions (NH3, NO, N2O) from unmanaged ecosystems, managed agricultural lands, and biomass burning will be represented. Wet and dry deposition fluxes of Nr species from the atmosphere will be provided as sources to the land model. The proposal will leverage a	33,000	2016
Trustees Of Columbia University In The City Of New York	NY	Reactive nitrogen biogeochemical cycling in the GFDL Earth System Models: Advancingunderstanding of atmosphere-land Interactions under changing climate and land use	The goal of the project is to improve the representation of the formation, radiative properties, internal mixing, and heterogeneous sources and sinks of nitrate aerosol, to be incorporated into a new version of the GFDL atmospheric model, AM3N. In the land model, we plan to represent Nr loss through denitrification in soils under anoxic conditions, including an explicit treatment of microbial processes. Runoff of Nr and cycling in rivers will be represented globally. The model will use improved scenarios of historical and future land management practices. We propose to improve the characterization of the Nr emissions and deposition through online coupling between the atmosphere and land components of the GFDL ESM. Speciated Nr emissions (NH3, NO, N2O) from unmanaged ecosystems, managed agricultural lands, and biomass burning will be represented. Wet and dry deposition fluxes of Nr species from the atmosphere will be provided as sources to the land model. The proposal will leverage and	33,000	2016
Colorado State University	CO	Reactive nitrogen biogeochemical cycling in the GFDL Earth System Models: Advancingunderstanding of atmosphere-land interactions under changing climate and land use	The goal of the project is to improve the representation of the formation, radiative properties, internal mixing, and heterogeneous sources and sinks of nitrate aerosol, to be incorporated into a new version of the GFDL atmospheric model, AM3N. In the land model, we plan to represent Nr loss through denitrification in soils under anoxic conditions, including an explicit treatment of microbial processes. Runoff of Nr and cycling in rivers will be represented globally. The model will use improved scenarios of historical and future land management practices. The project will improve the characterization of the Nr emissions and deposition through online coupling between the atmosphere and land components of the GFDL ESM. Speciated Nr emissions (NH3, NO, N2O) from unmanaged ecosystems, managed agricultural lands, and biomass burning will be represented. Wet and dry deposition fluxes of Nr species from the atmosphere will be provided as sources to the land model.The proposal will leverage an	32,891	2016
Alaska Institute for Justice	AK	Resilient Alaska Native Coastal Communities: Integrated Social Ecological Monitoring and Assessment Supporting Adaptive Decisions.	Introduction to the Problem: A rapidly changing climate in the Arctic is dramaticallyimpacting the health and well-being of Alaska Native communities. Erosion and repeated extreme weather events damage infrastructure, including health clinics and water and sewage treatment facilities. Saline intrusion and thawing permafrost impact access to potable water. In the most extreme cases, accelerating rates of erosion are life-threatening and are causing Alaska Native communities to choose to relocate their entire community. Rationale: This research strives to increase the adaptive capacity of Alaska Native communities experiencing the impacts of climate-induced environmental change on their health and well-being. Community engagement and empowerment are critical to any process aiming to improve the adaptive capacity of Alaska Native communities. By developing new and building upon existing trust relationships, learning from, and co-producing knowledge with communities, we seek to develop ada	148,612	2016

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University Corporation for Atmospheric Research	CO	Role of stratospheric processes in predicting ENSO-NAO connections on subseasonal time scale	There is increasing evidence that stratospheric processes and stratospheric-tropospheric couplingcontribute to an enhanced predictive skill of tropospheric phenomena, including ElNi o/Southern Oscillation-North Atlantic Oscillation (ENSO-NAO) connections on seasonaltime scale. The role of the stratosphere on the predictive skill on the subseasonal time scale hasnot been systematically explored, and the available data and model studies are not conducive tounderstanding the responsible processes. This joint proposal between CIRES-University ofColorado/NOAA-ESRL-Physical Sciences Division and CGD-NCAR aims to improve ourunderstanding of the role of the stratosphere on the predictability of the NAO and relatedextremes and to quantify to what extend NAO predictability can be improved by including awell-resolved stratosphere in a subseasonal modeling framework.This proposed project has three main objectives:1. To improve our understanding of the role of the stratosphere on the predictability	83,392	2016
UNIVERSITY OF NEW MEXICO	NM	Sea Ice Mechanics and Ice Thickness Distribution: Development, Evaluation, and Application of an Elastic Decohesive Sea Ice Model	The shrinking extent and thickness of the Arctic sea ice cover, as well as the major loss of multi-year pack ice is allowing greater access to the Arctic. In order to make use of this new accessibility efficiently and to guarantee safe operations, high-resolution sea ice forecasts are required on a variety of time scales, from hours to days, months, and seasons. Currently, shortcomings in our modeling capability preclude accurate prediction of ice characteristics on the necessary variety of temporal and spatial scales. The ability to simulate the ice edge, the space and time evolution of the pack ice, as well as ice types, thickness distribution, strength and state of deformation is crucial to accurate sea ice forecasting.We propose to improve the representation of sea ice mechanics in general circulation models and Earth system models in order to advance the short-term (days to months), high- resolution (tens of meters to kilometers) predictive capabilities of these models. We will pu	195,959	2016
University of Alaska Fairbanks	AK	Seasonal Climate Forecasting Applied to Wildland Fire Management in Alaska and Northwest Canada	The goal of this proposal is to compute and validate forecast products for fire managers in Alaska on the subseasonal and seasonal timescales, and make them available operationally. The project will extend the forecast lead time of products already computed from short-range forecasts to several months using input from CFSv2 (for the 2-week time scale) and NMME (for the seasonal scale). A map-typing methodology already developed and used in the western US to evaluate lightning ignition risk will be extended to Alaska. The series of tasks in the projects involves a validation phase based on NMME re-forecasts, a first real-time test in summer 2007, further refinements of the products based on the real-time assessment, a second real-time phase in summer 2008, and a plan for subsequent operational use and archiving of the products.	311,016	2016
University of Washington	WA	Seasonal to interannual variability and predictability of Arctic summertime sea ice associated with tropically forced planetary wave patterns	Increases in economic, environmental, and security interests in the Arctic demand improved prediction capabilities. The proposed project will explore a new path towards improved predictions of Arctic sea ice. We will investigate how teleconnections between tropical sea surface temperatures (SST) and high latitude circulation patterns can be exploited for sea ice predictions. Recent climate change in the Arctic is generally attributed to anthropogenic drivers and related feedbacks between sea ice, the ocean, and the atmosphere. However, work by Ding et al. (2014) and others (e.g.Trenberth et al. 2014) suggest that tropical Pacific SST variability is important in modulating recent Arctic climate variability by influencing the high-latitude atmospheric circulation. So far, these papers have examined the teleconnection between tropical SSTs and Arctic circulation and surface air temperatures. One unresolved question is how much does this tropical-Arctic teleconnection affect sea ice variab	131,346	2016
The Regents of the University of Colorado	CO	Source Attribution of Greenhouse Gases in the Southeast at the Interface of Biogenic and Anthropogenic Emissions: Multi-scale Inverse Modeling and Uncertainty Quantification	The overarching goal of this project is to constrain CO2 and CH4 emissions in the southeastern US from urban, biogenic, and oil-&-gas-related sources and sinks. Multiple state-of-the-art inverse modeling approaches will be used to assimilate a combination of in situ measurements from recent field campaigns (SENEX), NOAA flask measurements, and observations from tall towers. Correlations with co-measured species (NOy, SO2, and CO) will be used to provide additional constraints on greenhouse gas fluxes and for sector attribution. The transport histories of air masses sampled by SENEX flights will be simulated using a combination of Eulerian (GEOS-Chem and CMAQ) and Lagrangian (FLEXPART-WRF) transport models. SENEX observations will be assimilated using two variational inversions coupled with GEOS-Chem and FLEXPART-WRF and a probabilistic Bayesian Markov Chain Monte Carlo (MCMC) inversion incorporating these along with CMAQ. The Lagrangian tracer-ratio inversion technique has been sho	70,667	2016
BATTELLE MEMORIAL INSTITUTE	WA	Studies of Atmospheric Brown Carbon Chemistry in Support of the FIREX Campaign	The proposed work will characterize the chemical composition of BrC formed in FIREX studies; identify key chromophores, their light-absorbing properties and concentrations; and examine their transformation upon atmospheric aging. This information is critically important to obtaining predictive understanding of the regional (e.g. Western US) and global impact of BC on the atmosphere. This proposal directly addresses the NOAA Earth System Science (ESS) research programs specific areas of interest: research that capitalizes on FIREX by seeking to support studies of emissions and chemical transformation resulting from prescribed and wildfire burning in Western US. The proposed research will address the following questions aligned with the FIREX objectives: 1) What is the chemical composition, molecular identity and light-absorption properties of BrC chromophores associated with emissions of aerosols from North American fires? 2) What are the chemical transformations of BrC chromophores	120,000	2016

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Regents of the University of California, The	CA	Studies of Atmospheric Brown Carbon Chemistry in Support of the FIREX Campaign	The proposed work will characterize the chemical composition of BrC formed in FIREX studies; identify key chromophores, their light-absorbing properties and concentrations; and examine their transformation upon atmospheric aging. This information is critically important to obtaining predictive understanding of the regional (e.g. Western US) and global impact of BC on the atmosphere. This proposal directly addresses the NOAA Earth System Science (ESS) research program's specific areas of interest: research that capitalizes on FIREX by seeking to support studies of emissions and chemical transformation resulting from prescribed and wildfire burning in Western US. The proposed research will address the following questions aligned with the FIREX objectives: 1) What is the chemical composition, molecular identity and light-absorption properties of BrC chromophores associated with emissions of aerosols from North American fires? 2) What are the chemical transformations of BrC chromophores d	80,000	2016
UNIVERSITY OF MIAMI	FL	Sub-Seasonal Prediction with CCSM4	The goal of this proposal is to contribute to the coordinated sub-seasonal, multi-model prediction experiment by producing retrospective and experimental real-time subseasonal forecasts with CCSM4, following a previously-agreed protocol. In addition to the forecast production, the project will investigate a) the skill of CCSM4 in predicting sub-seasonal phenomena associated with sources of predictability (MJO, NAO, blocking, soil moisture variability), and their relationship with high-impact weather events; b) the relative contribution of land-surface versus atmospheric initialization; and c) the physical feedbacks that contribute to the initiation of droughts in the US Great Plains. Collaborations are planned in the investigation of topic c) with the goal of improving the use of sub-seasonal forecast information in decision support by Texas water managers. The first year of the project is mainly devoted to the production of re-forecasts, and their validation in terms of process-base	69,793	2016
The University of Texas at Austin	TX	Sub-Seasonal Prediction with CCSM4	The goal of this proposal is to contribute to the coordinated sub-seasonal, multi-model prediction experiment by producing retrospective and experimental real-time subseasonal forecasts with CCSM4, following a previously-agreed protocol. In addition to the forecast production, the project will investigate a) the skill of CCSM4 in predicting sub-seasonal phenomena associated with sources of predictability (MJO, NAO, blocking, soil moisture variability), and their relationship with high-impact weather events; b) the relative contribution of land-surface versus atmospheric initialization; and c) the physical feedbacks that contribute to the initiation of droughts in the US Great Plains. Collaborations are planned in the investigation of topic c) with the goal of improving the use of sub-seasonal forecast information in decision support by Texas water managers. The first year of the project is mainly devoted to the production of re-forecasts, and their validation in terms of process-base	49,393	2016
George Mason University	VA	Sub-Seasonal Prediction with CCSM4	The goal of this proposal is to contribute to the coordinated sub-seasonal, multi-model prediction experiment by producing retrospective and experimental real-time subseasonal forecasts with CCSM4, following a previously-agreed protocol. In addition to the forecast production, the project will investigate a) the skill of CCSM4 in predicting sub-seasonal phenomena associated with sources of predictability (MJO, NAO, blocking, soil moisture variability), and their relationship with high-impact weather events; b) the relative contribution of land-surface versus atmospheric initialization; and c) the physical feedbacks that contribute to the initiation of droughts in the US Great Plains. Collaborations are planned in the investigation of topic c) with the goal of improving the use of sub-seasonal forecast information in decision support by Texas water managers. The first year of the project is mainly devoted to the production of re-forecasts, and their validation in terms of process-base	50,475	2016
UNIVERSITY OF MARYLAND	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	159,296	2016
UNIVERSITY OF MARYLAND	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	4,620	2016
UNIVERSITY OF MARYLAND	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	82,645	2016
UNIVERSITY OF MARYLAND	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	1,600	2016
UNIVERSITY OF MARYLAND	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	5,154	2016

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University of Maryland, College Park	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	14,961	2016
University of Maryland, College Park	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	241,672	2016
University of Maryland, College Park	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	544	2016
University of Maryland, College Park	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	18,750	2016
University of Maryland, College Park	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	63,059	2016
University of Maryland, College Park	MD	The Cooperative Institute for Climate and Satellites (CICS-M) at the University of Maryland	a multi-institution partnership led by the University of Maryland at College Park (UMCP) that performs collaborative research aimed at enhancing NOAA's ability to use satellite observations and Earth System models to advance the national climate mission, including monitoring, understanding, predicting and communicating information on climate variability and change.	9,311	2016
UNIVERSITY OF MIAMI	FL	The Cooperative Institute for Marine and Atmospheric Studies (CIMAS) at the University of Miami	CIMAS research themes include: (1) Climate Research and Impact (2) Tropical Weather (3) Sustained Ocean and Coastal Observations (4) Ocean Modeling (5) Ecosystem Modeling and Forecasting (6) Ecosystem Management and (7) Protection and Restoration of Resources.	750,419	2016
UNIVERSITY OF MIAMI	FL	The Cooperative Institute for Marine and Atmospheric Studies (CIMAS) at the University of Miami	CIMAS research themes include: (1) Climate Research and Impact (2) Tropical Weather (3) Sustained Ocean and Coastal Observations (4) Ocean Modeling (5) Ecosystem Modeling and Forecasting (6) Ecosystem Management and (7) Protection and Restoration of Resources.	542,841	2016
UNIVERSITY OF CALIFORNIA, SAN DIEGO	CA	The Cooperative Institute for Marine Ecosystems and Climate (CIMEC) is a consortium of seven California universities: SIO/UCSD, CSU LA, Humboldt State U, UC Davis, UCLA, UCSB and UCSC.	Research conducted by CIMEC falls under four themes: A) Climate and Coastal Observations, Analysis, and Prediction, B) Climate Research and Impacts, C) Marine Ecosystems, and D) Ecosystem-Based Management.	419,825	2016
UNIVERSITY OF CALIFORNIA, SAN DIEGO	CA	The Cooperative Institute for Marine Ecosystems and Climate (CIMEC) is a consortium of seven California universities: SIO/UCSD, CSU LA, Humboldt State U, UC Davis, UCLA, UCSB and UCSC.	Research conducted by CIMEC falls under four themes: A) Climate and Coastal Observations, Analysis, and Prediction, B) Climate Research and Impacts, C) Marine Ecosystems, and D) Ecosystem-Based Management.	12,175	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	100,000	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	750,000	2016

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The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	200,000	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	100,000	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	250,000	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	200,000	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	18,503	2016

NOAA/OAR Climate Competetive Research

The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	176,264	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	259,000	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	(18,503)	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	(176,264)	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	18,503	2016

NOAA/OAR Climate Competetive Research

The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	176,264	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	63,171	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	1,453	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	2,897,074	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	15,759	2016

NOAA/OAR Climate Competetive Research

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The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	61,311	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	195,872	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	31,696	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	39,520	2016

NOAA/OAR Climate Competetive Research

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The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	532,261	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	21,842	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	101,693	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	350,000	2016

NOAA/OAR Climate Competetive Research

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The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	142,801	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	4,135	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	5,420	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	943	2016

NOAA/OAR Climate Competetive Research

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The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	87,308	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	150,000	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	16,645	2016
The Regents of the University of Colorado	CO	The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado	CIRES carries out research in six theme areas to Optimize modeling and observing systems for disciplines such as air quality, atmospheric chemistry, physical atmospheric and oceanic processes, cryospheric processes, space weather, data centers, and data management; Work to gain an understanding of and predict climate change and its impacts; Characterize and identify the internal processes of our planet, including processes of the core mantle boundary, convection within Earth's mantle, and how the convection affects the surface of the planet; Engage in a wide range of integrating activities in research, education, and outreach; Study the complex web of biochemical and ecological processes and their interaction with the lithosphere, atmosphere, and hydrosphere; and Research the mechanisms of atmospheric transport on climate and air quality, chemical transformation of products of biomass burning, air/sea gas transfer, and ozone pollution with a regional focus to address particular confluences of geography, demographics, weather and climate regimes.	(150,000)	2016

NOAA/OAR Climate Competetive Research

Trustees Of Columbia University In The City Of New York	NY	The Dynamical Mechanisms and Potential Predictability of Indian and Pacific Ocean Influences on Seasonal North American Drought	The proposed work would seek to determine the varying responses of precipitation over North America to different SST anomalies in the Indo-Pacific basins by season. The work plan involves an investigation of the link between Indian and tropical Pacific SST anomalies and North American precipitation. The work would determine physical mechanisms and how they vary by location of forcing and season to cause the observed seasonal cycle of predictability. The team would perform diagnostic analysis of transient adjustment modeling experiments, and would examine the causes, dynamics, and predictability of two great North American droughts (the post 1998 drought that still goes on but with a focus on the 1998 to 2004 period, and the early to mid-1890s drought).	50,000	2016
University of Hawaii Systems	HI	The Joint Institute for Marine and Atmospheric Research (JIMAR)	JIMAR was established to pursue the common research interests of NOAA and the UH in oceanic, atmospheric, and geophysical research. Major areas of research in JIMAR include ecosystem forecasting, ecosystem monitoring, ecosystem-based management, protection and restoration of resources, equatorial oceanography, climate research and impacts, tropical meteorology, and tsunami and other long-period ocean waves.	19,173	2016
University of Hawaii Systems	HI	The Joint Institute for Marine and Atmospheric Research (JIMAR)	JIMAR was established to pursue the common research interests of NOAA and the UH in oceanic, atmospheric, and geophysical research. Major areas of research in JIMAR include ecosystem forecasting, ecosystem monitoring, ecosystem-based management, protection and restoration of resources, equatorial oceanography, climate research and impacts, tropical meteorology, and tsunami and other long-period ocean waves.	100,657	2016
UNIVERSITY OF HAWAII SYSTEMS	HI	The Joint Institute for Marine and Atmospheric Research (JIMAR)	JIMAR was established to pursue the common research interests of NOAA and the UH in oceanic, atmospheric, and geophysical research. Major areas of research in JIMAR include ecosystem forecasting, ecosystem monitoring, ecosystem-based management, protection and restoration of resources, equatorial oceanography, climate research and impacts, tropical meteorology, and tsunami and other long-period ocean waves.	11,528	2016
UNIVERSITY OF HAWAII SYSTEMS	HI	The Joint Institute for Marine and Atmospheric Research (JIMAR)	JIMAR was established to pursue the common research interests of NOAA and the UH in oceanic, atmospheric, and geophysical research. Major areas of research in JIMAR include ecosystem forecasting, ecosystem monitoring, ecosystem-based management, protection and restoration of resources, equatorial oceanography, climate research and impacts, tropical meteorology, and tsunami and other long-period ocean waves.	60,520	2016
UNIVERSITY OF HAWAII SYSTEMS	HI	The Joint Institute for Marine and Atmospheric Research (JIMAR)	JIMAR was established to pursue the common research interests of NOAA and the UH in oceanic, atmospheric, and geophysical research. Major areas of research in JIMAR include ecosystem forecasting, ecosystem monitoring, ecosystem-based management, protection and restoration of resources, equatorial oceanography, climate research and impacts, tropical meteorology, and tsunami and other long-period ocean waves.	23,056	2016
UNIVERSITY OF HAWAII SYSTEMS	HI	The Joint Institute for Marine and Atmospheric Research (JIMAR)	JIMAR was established to pursue the common research interests of NOAA and the UH in oceanic, atmospheric, and geophysical research. Major areas of research in JIMAR include ecosystem forecasting, ecosystem monitoring, ecosystem-based management, protection and restoration of resources, equatorial oceanography, climate research and impacts, tropical meteorology, and tsunami and other long-period ocean waves.	121,038	2016
University of Washington	WA	The Joint Institute for the Study of the Atmosphere & Ocean (JISAO) at the University of Washington	JISAO scientists are at the forefront of basic and applied investigations on such critical issues as climate change and its impacts on humans and ecosystems, ocean acidification, fisheries assessments and tsunami modeling and forecasting.	185,041	2016
University of Washington	WA	The Joint Institute for the Study of the Atmosphere & Ocean (JISAO) at the University of Washington	JISAO scientists are at the forefront of basic and applied investigations on such critical issues as climate change and its impacts on humans and ecosystems, ocean acidification, fisheries assessments and tsunami modeling and forecasting.	15	2016
University of Washington	WA	The Joint Institute for the Study of the Atmosphere & Ocean (JISAO) at the University of Washington	JISAO scientists are at the forefront of basic and applied investigations on such critical issues as climate change and its impacts on humans and ecosystems, ocean acidification, fisheries assessments and tsunami modeling and forecasting.	485	2016
University of Washington	WA	The Joint Institute for the Study of the Atmosphere & Ocean (JISAO) at the University of Washington	JISAO scientists are at the forefront of basic and applied investigations on such critical issues as climate change and its impacts on humans and ecosystems, ocean acidification, fisheries assessments and tsunami modeling and forecasting.	26,680	2016
University of Wisconsin System	WI	The Predictability of Extreme Arctic Sea Ice Variations in a Rapidly Changing Climate	Arctic sea ice has been diminishing dramatically in recent years, reaching a record low in 2012 after a previous sudden drop in 2007. Climate model simulations also generate such large and rapid summertime ice loss events in the near future. However, the natural variability of the Arctic system is very high, and models exhibit instances of increasing sea ice cover even well into the 21st century. Improved understanding of the character, impacts, and potential forecasting of these types of extreme sea ice events has great societal relevance for Arctic marine access, seasonal forecasting, and climate variability.In this project we will assess the processes responsible for, and the predictability of, rapid Arctic sea ice variations, with an emphasis on the implications for marine navigation and extreme weather. We will utilize the Community Earth System Model 1 (CESM1), one of the better models from the CMIP3/CMIP5 archives. CESM1 simulates 20th-century Arctic sea ice very realistically a	151,950	2016

NOAA/OAR Climate Competetive Research

University Corporation for Atmospheric Research	CO	The Predictability of Extreme Arctic Sea Ice Variations in a Rapidly Changing Climate	Arctic sea ice has been diminishing dramatically in recent years, reaching a record low in 2012 after a previous sudden drop in 2007. Climate model simulations also generate such large and rapid summertime ice loss events in the near future. However, the natural variability of the Arctic system is very high, and models exhibit instances of increasing sea ice cover even well into the 21st century. Improved understanding of the character, impacts, and potential forecasting of these types of extreme sea ice events has great societal relevance for Arctic marine access, seasonal forecasting, and climate variability.In this project we will assess the processes responsible for, and the predictability of, rapid Arctic sea ice variations, with an emphasis on the implications for marine navigation and extreme weather. We will utilize the Community Earth System Model 1 (CESM1), one of the better models from the CMIP3/CMIP5 archives. CESM1 simulates 20th-century Arctic sea ice very realistically a	64,052	2016
University of Washington	WA	The Predictability of Extreme Arctic Sea Ice Variations in a Rapidly Changing Climate	Arctic sea ice has been diminishing dramatically in recent years, reaching a record low in 2012 after a previous sudden drop in 2007. Climate model simulations also generate such large and rapid summertime ice loss events in the near future. However, the natural variability of the Arctic system is very high, and models exhibit instances of increasing sea ice cover even well into the 21st century. Improved understanding of the character, impacts, and potential forecasting of these types of extreme sea ice events has great societal relevance for Arctic marine access, seasonal forecasting, and climate variability.In this project we will assess the processes responsible for, and the predictability of, rapid Arctic sea ice variations, with an emphasis on the implications for marine navigation and extreme weather. We will utilize the Community Earth System Model 1 (CESM1), one of the better models from the CMIP3/CMIP5 archives. CESM1 simulates 20th-century Arctic sea ice very realistically a	31,343	2016
Trustees Of Columbia University In The City Of New York	NY	The Relationship of Tropical Cyclones to MJO and ENSO in the S2S Database	It is very well established that tropical cyclones (TCs) are modulated globally by the Madden-Julian Oscillation (MJO) and the El Ni o-Southern Oscillation (ENSO). Due to theserelationships, TC activity is to some extent predictable on both intraseasonal and seasonal timescales. Given the recent effort to develop TC forecasts on intraseasonal time scales acomprehensive analysis of the skill of various models in simulating and predicting TC activity atthese time scales is warranted. The S2S dataset includes many high-resolution global weatherand climate models that have capability to simulate tropical cyclone activity well. It is the idealdataset to explore in depth the skill of TC forecast models.First, we will detect and track tropical cyclones (TCs) in the S2S model output to generate TCtracks for this dataset. We will then analyze various aspects of the TC climatology in the S2Smodels, e.g., genesis, tracks, seasonality, intensity. Given that TC seasonal forecasts still havelimited	170,377	2016
University of Utah, The	UT	The Uintah Basin Greenhouse Gas Study: Understanding emissions of CO2 and CH4 from oil and gas fields	The proposed project will leverage prior research by NOAA scientists in the Uintah Basin, estimating GHG emissions from oil/gas development by carrying out the following: Continuous, year-round measurements of CO2 and CH4 at multiple sites in the Uintah Basin Analysis of existing NOAA airborne data from flights carried out in the Uintah Basin Mobile observations to characterize spatial variability of GHG concentrations, both close to and away from oil and gas fields Meteorological measurements to critically evaluate the simulated atmospheric transport Flask-based stable isotope measurements of CO2 and CH4 that would distinguish biogenic from industrial sources Atmospheric modeling to relate observed enhancements CO2 and CH4 to emissions from the oil and gas developmentsObjectives: Establish continuous measurements of CO2 and CH4 in the Uintah Basin Estimate emissions of CO2 and CH4 over multiple years Determine leakage rates of CH4 over the entire Uintah Basin Detect potentia	194,071	2016
GEORGE MASON UNIVERSITY	VA	The Western Transition Zone as a Gatekeeper for the North Atlantic MOC Throughput	The Atlantic Meridional Overturning Circulation (AMOC) requires significant transport between the North Atlantic subtropical and subpolar gyres. This transport contributes appreciably to the Atlantic's mean ocean heat transport and its variability has been linked to climate variations on a wide range of time scales, including paleoclimate shifts and Atlantic multidecadal sea surface temperature variability. Despite the importance to our climate system, no clear consensus on the dynamical mechanisms controlling this throughput and its variability has emerged to date. Furthermore, recent Lagrangian studies have challenged the traditional understanding of the geometry of the throughput in both the upper and lower AMOC limbs. The goal of our work is to build on past Eulerian and Lagrangian studies in order to work toward a consensus on AMOC variability mechanisms.We believe that such a consensus is possible with a focus on the dynamics at the western margin of the subtropical-subpolar gyre	83,518	2016

NOAA/OAR Climate Competetive Research

DUKE UNIVERSITY	NC	The Western Transition Zone as a Gatekeeper for the North Atlantic MOC Throughput	The Atlantic Meridional Overturning Circulation (AMOC) requires significant transport between the North Atlantic subtropical and subpolar gyres. This transport contributes appreciably to the Atlantic's mean ocean heat transport and its variability has been linked to climate variations on a wide range of time scales, including paleoclimate shifts and Atlantic multidecadal sea surface temperature variability. Despite the importance to our climate system, no clear consensus on the dynamical mechanisms controlling this throughput and its variability has emerged to date. Furthermore, recent Lagrangian studies have challenged the traditional understanding of the geometry of the throughput in both the upper and lower AMOC limbs. The goal of our work is to build on past Eulerian and Lagrangian studies in order to work toward a consensus on AMOC variability mechanisms.We believe that such a consensus is possible with a focus on the dynamics at the western margin of the subtropical-subpolar gyre	287,834	2016
The Regents of the University of California, UCLA	CA	Towards an Improved Understanding of the Initiation and Propagation of the Madden-Julian Oscillation	The Madden-Julian Oscillation (MJO) exerts significant influences on global climate and weather, and serves as a critical basis of the Seamless Prediction concept by bridging the forecasting gap between medium- to long-range weather forecasts and short-term climate prediction. However, our understanding of the essential MJO physics is still elusive. The MJO remains poorly represented in current climate models, which leaves us greatly disadvantaged in undertaking climate change studies, particularly in projecting future changes in extreme events that are significantly modulated by the MJO.Motivated by exciting recent developments in MJO observations (the DYNAMO field campaign), modeling (the MJO Task Force/GEWEX GASS MJO Inter-comparison Project), and theories (e.g., the moisture mode), and by taking advantage of the availability of these unprecedented datasets, we propose to form a climate process team to expedite investigations on key physical processes responsible for initiation and	392,488	2016
Brown University	RI	Tracking Nitrogen Oxides Emissions and Nitrate Formation in Biomass Burning Plumes	The Fire Influence on Regional and Global Environments Experiment (FIREX) proposes toinvestigate the influence of fires in the western U.S. on climate and air quality, via an intensive,multi-platform, campaign. As part of this, we propose to track wildfire derived nitrogen oxides(NOx = NO+NO2) and their influence on the oxidative formation of nitrate (particulate NO3- and gaseous nitric acid (HNO3), and nitrous acid (HONO)). We will quantify the influence ofbiomass burning on atmospheric chemistry in the western U.S. using the concentration andisotopic composition of NOx, NO3, and HONO. The isotopes of these species offer a new tool for tracking the influence of biomass burning on the formation and chemistry of these important reactive species. Using a recently developed method that captures NOx without any fractionation effects, along with established methods for collecting soluble gases and aerosols, we will target daytime and nighttime air impacted directly by emissions from biomass	93,635	2016
University System of New Hampshire	NH	Tracking Nitrogen Oxides Emissions and Nitrate Formation in Biomass Burning Plumes	The Fire Influence on Regional and Global Environments Experiment (FIREX) proposes toinvestigate the influence of fires in the western U.S. on climate and air quality, via an intensive,multi-platform, campaign. As part of this, we propose to track wildfire derived nitrogen oxides(NOx = NO+NO2) and their influence on the oxidative formation of nitrate (particulate NO3- and gaseous nitric acid (HNO3), and nitrous acid (HONO)). We will quantify the influence ofbiomass burning on atmospheric chemistry in the western U.S. using the concentration andisotopic composition of NOx, NO3, and HONO. The isotopes of these species offer a new tool for tracking the influence of biomass burning on the formation and chemistry of these important reactive species. Using a recently developed method that captures NOx without any fractionation effects, along with established methods for collecting soluble gases and aerosols, we will target daytime and nighttime air impacted directly by emissions from biomass	51,600	2016
JOHNS HOPKINS UNIVERSITY, THE	MD	Transient tracer fingerprints of Atlantic Meridional Overturning Circulation in Observations and Models	Transient tracers offer a unique and important window into the Atlantic Meridional Overturning Circulation (AMOC). While they have been used to estimate the total rate of formation of NADW and to trace the pathways by which watermasses spread, less attention has been paid to the ways in which tracers can tell us about how the overturning is changing. Increasing amounts of observational data and model simulations with transient tracers offer new opportunities to understand the relationship between transient tracers and the large-scale ocean circulation. This proposal has three parts:1. Analysis of coupled climate models: As demonstrated in this proposal, transient tracers in climate models can be better correlated with long-period variability in the overturning than spot measurements of the overturning itself. However, the fingerprint of overturning variability in tracers such as ideal age and oxygen has a complex three-dimensional spatial structure, with different responses at differen	374,731	2016

NOAA/OAR Climate Competetive Research

GEORGIA TECH RESEARCH CORPORATION	GA	Understanding drivers and impacts of CGCM biases in representing the decadal variability of Labrador Sea convection	The Labrador Sea (LS) is one of the few regions in the world ocean where deep convection occurs. The intense air-sea interaction drives the convective mixing and the site acts as a window through which anthropogenic carbon is sequestered into the interior ocean. Recent work highlights that buoyancy forcing over the Labrador Sea is key in controlling the Atlantic Meridional Overturning Circulation (AMOC) and that AMOC inter-annual signals are closely related to the variability of the Labrador Sea convection. Historic observations collected over the past 60 years show that the LS convective activity undergoes dramatic interannual-to-decadal variability and -within the limitation of the available measurements - no statistically significant trend. A model integration performed using a regional ocean model (ROMS, Regional Oceanic Modeling System) run at 5km horizontal resolution over the LS can reproduce the observed variability. However, coupled general circulation models (CGCMs) from the	232,012	2016
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH	CO	Understanding the Freshwater Budget of the Atlantic Ocean: Controls, Responses, and the Role of the AMOC	The Atlantic Meridional Overturning Circulation (AMOC) is an interactive player in the Atlantic Ocean freshwater budget. In model simulations, the AMOC responds to surface freshwater flux (precipitation - evaporation + river runoff + ice melt; P-E+R+M) perturbations in the subpolar North Atlantic; it is also influenced by P-E+R+M over the broader Atlantic through salt/freshwater advection and inter-basin exchanges (e.g., Agulhas Leakage). In turn, the AMOC drives changes in salt transport across 35 S and affects P-E+R+M through its influence on Atlantic sea surface temperature, sea ice extent, and other processes. Yet, the intrinsic time scales and mechanisms driving and responding to Atlantic Ocean freshwater budget variability are not known. Moreover, changes in the global hydrological cycle, melting of the Greenland Ice Sheet, and retreat of Arctic sea ice are among the most robust features of climate projections. We propose to investigate the interconnections between P-E+R+M and oc	73,501	2016
REGENTS OF THE UNIVERSITY OF CALIFORNIA, THE	CA	Understanding the Freshwater Budget of the Atlantic Ocean: Controls, Responses, and the Role of the AMOC	The Atlantic Meridional Overturning Circulation (AMOC) is an interactive player in the Atlantic Ocean freshwater budget. In model simulations, the AMOC responds to surface freshwater flux (precipitation - evaporation + river runoff + ice melt; P-E+R+M) perturbations in the subpolar North Atlantic; it is also influenced by P-E+R+M over the broader Atlantic through salt/freshwater advection and inter-basin exchanges (e.g., Agulhas Leakage). In turn, the AMOC drives changes in salt transport across 35 S and affects P-E+R+M through its influence on Atlantic sea surface temperature, sea ice extent, and other processes. Yet, the intrinsic time scales and mechanisms driving and responding to Atlantic Ocean freshwater budget variability are not known. Moreover, changes in the global hydrological cycle, melting of the Greenland Ice Sheet, and retreat of Arctic sea ice are among the most robust features of climate projections. We propose to investigate the interconnections between P-E+R+M and oc	120,733	2016
UNIVERSITY OF WASHINGTON	WA	Understanding the freshwater budget of the Atlantic Ocean: Controls, Responses, and the Role of the AMOC	The Atlantic Meridional Overturning Circulation (AMOC) is an interactive player in the Atlantic Ocean freshwater budget. In model simulations, the AMOC responds to surface freshwater flux (precipitation - evaporation + river runoff + ice melt; P-E+R+M) perturbations in the subpolar North Atlantic; it is also influenced by P-E+R+M over the broader Atlantic through salt/freshwater advection and inter-basin exchanges (e.g., Agulhas Leakage). In turn, the AMOC drives changes in salt transport across 35 S and affects P-E+R+M through its influence on Atlantic sea surface temperature, sea ice extent, and other processes. Yet, the intrinsic time scales and mechanisms driving and responding to Atlantic Ocean freshwater budget variability are not known. Moreover, changes in the global hydrological cycle, melting of the Greenland Ice Sheet, and retreat of Arctic sea ice are among the most robust features of climate projections. We propose to investigate the interconnections between P-E+R+M and oc	272,324	2016
THE RESEARCH FOUNDATION OF STATE UNIVERSITY OF NEW YORK	NY	Understanding the Sources of Subseasonal Predictability of Extratropical Cyclone Activity and Improving Their Representation in Forecast Systems	the mid-latitudes, including heavy precipitation, high winds, coastal storm surges, andextreme cold events. On the other hand, lack of extratropical cyclone activity (ECA) in summeris linked to extreme heat. Hence skillful predictions of future cyclone activity will provide policymakers, emergency management, and stakeholders advanced warnings to prepare for mitigationmeasures. Unfortunately at present the National Weather Service does not provide any suchforecast products in the subseasonal to seasonal time range.The goal of this project is to improve the subseasonal prediction of ECA and itsassociated weather extremes. It has three specific objectives: i) improve the understanding of thephysical drivers that give rise to ECA predictability; ii) improve the prediction of ECA and itsdrivers by focusing on the forecasting system set-up and model convection parameterizations; iii)improve the forecasting of weather extremes associated with ECA variability.To achieve these objectives, the	131,061	2016
University of Maryland, College Park	MD	Upgrading the CPC operational ocean monitoring to an eddy-permitting global ocean analysis using the Hybrid Global Ocean Data Assimilation System as a replacement for GODAS	This proposal aims to upgrade the CPC operational ocean reanalysis data assimilation system from its current GODAS (MOM3 + 3D-Var) system to a hybrid data assimilation system (MOM6 + GODAS-LETKF ensemble). The first year of the project will be dedicated to the implementation of the new system to achieve TRL 6, while the second year will focus on improvements to move towards operational implementation.	26,000	2016
US Global Change Research Program	WDC	US Global Change Research Program	The U.S. Global Change Research Program (USGCRP) was established by Presidential Initiative in 1989 and mandated by Congress in the Global Change Research Act (GCRA) of 1990 to "assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change."	694,680	2016

NOAA/OAR Climate Competetive Research

The Regents of the University of Colorado	CO	Using Snow Cover to Advance Sea Ice Forecast Models	Due to the rapid decline in Arctic sea ice extent and volume over the past decade, there has been a growing focus on developing capabilities for prediction. NOAA's Arctic Action Plan calls for an improvement in sea ice predictability ranging from the short term (e.g. daily and weekly) to seasonal to decadal time-scales. Such an effort is particularly important in light of the large variability seen in annual sea ice minima. To gain predictive skill, one must gain an understanding of sea ice variability and the coupled terrestrial, ocean and atmospheric systems that influence this variability.We propose to advance the understanding of Arctic sea ice variability and predictability by investigating several interrelated items that have been largely overlooked, but that we hypothesize will give further insight to the seasonal fate of sea ice. These items include (a) the influence of spring and early summer snow cover over Northern Hemisphere lands, (b) the atmospheric circulation patterns t	262,108	2016
University of Illinois	IL	Variability of Rossby Wave Breaking and its Impacts on the Large-scale Circulation and Extreme Weather: Implications for S2S Prediction and Predictability	Rossby wave breaking (RWB) is characterized by large-scale, irreversible overturning ofpotential vorticity (PV) on isentropic surfaces. The eddy-mean interaction involved inRWB is an important process for the maintenance and variability of the midlatitude jet,and mixing associated with RWB plays an important role in moisture and momentumtransport between the tropics and extratropics. In particular, extratropical PV intrusionmodulates the moisture distribution in the subtropical dry zone, which affects the infraredenergy loss and is an important factor in the global energy budget.RWB is also closely related to extreme weathers, such as blocking and atmosphericrivers. Our recent study revealed a strong relationship between RWB and Atlantictropical cyclones (TC). Anomalously frequent RWB enhances the equatorward intrusionof cold, dry extratropical air and leads to a significant reduction in precipitable water overthe tropical/subtropical Atlantic and an increase in vertical wind shear, bo	112,464	2016

45. At his Senate confirmation hearing, Secretary Ross expressed a strong desire to reverse the nation's seafood trade deficit. At the same time, however, the Commerce Department's fiscal year 2018 budget request proposes several things that are highly detrimental to this goal. First, it proposes a huge cut to the International Trade Administration's Global Markets business unit, a unit that actively works to increase U.S. exports. Secondly, the Department's budget request proposes significant cuts in NOAA's aquaculture research, including the complete elimination of the NOAA Sea Grant program and its work in this area. U.S. aquaculture can be a significant tool for improving the nation's competitiveness in the international market for fish, especially as much of the fish imported into the U.S. is itself the product of aquaculture overseas. How will the Department achieve the goal of reversing the nation's trade deficit in seafood if it is actively working to cut funding both for efforts to expand U.S. exports and for efforts to improve U.S. aquaculture?

ANSWER:

The President's FY 2018 Budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, NOAA made some difficult decisions to consolidate or eliminate programs, including extramural aquaculture research funded by Sea Grant. The Department of Commerce's FY18 funding request for the National Marine Fisheries Service (NMFS) includes $6.3 million for Aquaculture, which will be used to continue work to advance the domestic marine aquaculture industry, create jobs, provide sustainable seafood, and reduce the U.S. seafood trade deficit. NMFS' activities are aligned with four strategic goals:

1) Regulatory efficiency: Develop coordinated, consistent, and efficient regulatory processes for the marine aquaculture sector.

2) Tools for sustainable management: Encourage environmentally sustainable marine aquaculture using best available science.

3) Technology development and transfer: Develop technologies and provide extension services for the marine aquaculture sector.

4) Informed public: Improve public understanding of marine aquaculture.

The Honorable Derek Kilmer

Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Department of Commerce Budget Hearing

1. Congress recently reauthorized the Manufacturing Extension Partnership program by unanimous consent. The Administration's proposal to eliminate the Manufacturing Extension Partnership contradicts Congress' recent reauthorization and does not seem aligned with the President's focus on revitalizing American manufacturing. The program's stated goal is to help make manufacturers more competitive globally.

   In the state of Washington, our local MEP affiliate, Impact Washington, has had tremendous impact on manufacturers. Specifically, Impact Washington has provided over $488 Million in economic impact statewide and nearly $68 Million in my district alone over the last two years.

   The impact of our local MEP is not an anomaly. Nationally the MEP program has created or retained 86,602 jobs in FY16 alone. Additionally, a recent study by the W.E. Upjohn Institute of Employment Research found that total employment in the U.S. was over 142,000 higher because of MEP center projects than without the program. This estimate includes direct, indirect, and induced jobs generated by MEP projects. These jobs support additional manufacturing jobs critical to U.S. supply chains and jobs outside of manufacturing.

   Can you explain how eliminating the MEP program that has such local and national impact on job retention and growth for the manufacturing industry aligns with the President's focus on job growth?

ANSWER:

The Administration is committed to economic growth and creating American jobs, including manufacturing jobs, through robust regulatory reform, tax reform and better trade deals. The FY 2018 budget prioritizes rebuilding the military, making critical investments in the Nation's security, and providing the savings and efficiencies needed to keep the Nation on a responsible fiscal path. While the Budget proposes to eliminate Federal funding for the MEP program, we believe some MEP centers will be able to continue to provide useful services to manufacturers without ongoing Federal support, relying instead on revenue from client fees and partnerships.

2. The Budget proposes to eliminate the Economic Development Administration by the beginning of 2018. The EDA is the only federal agency focused exclusively on economic development. Amongst other things, the EDA partners with distressed communities to help them support their unique economic development goals and needs.

a. Can you explain your rationale for eliminating the EDA?

ANSWER:

The Administration's 2018 Budget prioritizes rebuilding the military and making critical investments in the Nation's security. It also identifies the savings and efficiencies needed to keep the Nation on a responsible fiscal path. Many difficult decisions and tradeoffs were necessary to reach the funding level provided in this budget, and the elimination of EDA is one of them. The President's budget aims to change the role and size of the Federal Government by prioritizing programs that serve the most critical functions and consolidating or eliminating duplicative or less critical programs.

The Administration's approach to economic development is to boost the entire economy through regulatory reform, unleashing energy resources, addressing unfair trading practices, and tax reform.

b. What Federal programs is the EDA duplicative of?

ANSWER:

As noted in the President's 2018 budget request, EDA's grant programs are duplicative of other economic development programs within the Federal Government. A 2011 Government Accountability Office (GAO) report found that each of the 80 economic development programs at the four departments it reviewed (Departments of Commerce, Housing and Urban Development, Agriculture, and the Small Business Administration) overlapped with at least one of the other programs reviewed. The proposed elimination of EDA is a part of a broader effort to eliminate duplicative economic development programs across the Federal Government.[1]

[1] Government Accountability Office: Efficiency and Effectiveness of Fragmented Economic Development Programs Are Unclear, GAO-11-477R, (May 2011).

c. Did the Department attempt to find a solution to this alleged duplication other than program elimination?

ANSWER:

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The Administration's approach to economic development is to boost the entire economy through regulatory reform, unleashing energy resources, addressing unfair trade practices, and tax reform.

d. Did the Department make any efforts to preserve the EDA? If so, what?

ANSWER:

Many difficult decisions and tradeoffs were necessary to reach the funding level provided in this budget, and the elimination of EDA is one of them. The President's budget aims to change the role and size of the Federal Government by prioritizing programs that serve the most critical functions and consolidating or eliminating duplicative or less critical programs.

The Administration's approach to economic development is to boost the entire economy through regulatory reform, unleashing energy resources, addressing unfair trade practices, and tax reform.

3. The Budget proposes for elimination the Minority Business Development Agency. A key component of MBDA's Business Center Network is providing minority firms with access to technical expertise and resources to grow their businesses. In Washington State alone, there are 92,807 minority-owned firms that contribute more than $54.6 billion annually in economic output. These firms employ more than 143,000 hard-working, tax-paying residents of Washington State. The MBDA Business Center in Tacoma, Washington, along with western regions MBDA offices, has helped businesses access over $200 million in loans and equity investments, as well as $800 million in procurement contracts.

   The region I represent is experiencing a construction boom, and the MBDA has been especially beneficial in connecting minority-owned businesses with the capital and resources they need to compete in this growing industry. Many of my constituents rely on the tools and resources provided by the MBDA, such as identification of procurement opportunities, bid estimating and pricing assistance, bond loaning and education, targeted teaming arrangements with sub-contractor and prime construction firms, and most importantly, strategic business counseling.

   a. Can you explain your rationale for eliminating the MBDA?

ANSWER:

The Administration's focus is to grow the economy through tax reform, regulatory reductions, unleashing our energy resources, and the removal of unfair trade practices. Our hope is that that will make a much better environment for all businesses including, minority businesses.

MBDA is a relatively small entity and a grant-making entity. MBDA has been proposed for elimination due to the duplicative activity between MBDA and the Small Business

Administration in their district offices and in their small business development centers. However, the President's proposal to eliminate the agency should not be viewed as an abandonment of the agency's core mission. Rather, it is an acknowledgment that the agency has succeeded in creating an environment that is more supportive of minority businesses today than it had been before the agency was founded way back in 1969. The Administration hopes that the overall lift to the economy will drive growth for minority businesses and other small businesses.

There also are similar efforts at the state and local level, as well as private sector efforts to encourage minority business development. The expectation is that those efforts will go unabated by the elimination of MBDA.

b. What efforts did the Department make to preserve the MBDA?

ANSWER:

The Administration's 2018 Budget prioritizes rebuilding the military and making critical investments in the Nation's security. It also identifies the savings and efficiencies needed to keep the Nation on a responsible fiscal path. Many difficult decisions and tradeoffs were necessary to reach the funding level provided in this budget, and the elimination of MBDA is one of them. The President's budget aims to change the role and size of the Federal Government by prioritizing programs that serve the most critical functions and consolidating or eliminating duplicative or less critical programs.

The Administration's approach to economic development in general is to boost the entire economy through regulatory reform, unleashing energy resources, tax reform and the removal of unfair trade practices.

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c. What is the agency's timeline for shuttering the MBDA?

ANSWER:

The estimated timeline for shuttering MBDA is approximately 90 days.

d. Can you explain how the Department is working to close the equality gap and help minority-owned businesses succeed?

ANSWER:

The Administration's 2018 Budget prioritizes rebuilding the military and making critical investments in the Nation's security. It also identifies the savings and efficiencies needed to keep the Nation on a responsible fiscal path. Many difficult decisions and tradeoffs were necessary to reach the funding level provided in this budget, and the elimination of MBDA is one of them. The President's budget aims to change the role and size of the Federal Government by prioritizing programs that serve the most critical functions and consolidating or eliminating duplicative or less critical programs.

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4. Access to high-speed Internet is crucial for rural communities, and developing and maintaining a high-quality telecommunications infrastructure, including broadband, is essential both for promoting economic growth and for expanding access to important services like health care and education. The President's Budget recommends $36 million for NTIA to establish policies and standards governing the internet and broadband. The Budget notes that NTIA will use the expertise of its BroadbandUSA program to "encourage and promote partnerships among state, municipal, non-profit, and private sector organizations and to support deployment of new community broadband systems." What plans does NTIA have to support the deployment of new broadband systems to rural communities?

ANSWER:

NTIA launched BroadbandUSA in January 2015 after recognizing that while communities may understand that broadband access and use are vital to their economic development, innovation, education, health care, and public safety needs, they often lack the resources and expertise to seize those benefits. BroadbandUSA assists, educates, and convenes government, community, and industry leaders working to advance broadband initiatives and policy. BroadbandUSA serves as a trusted and neutral strategic advisor, working with public and private sector partners to assess local broadband needs and gaps; identify possible funding and other resources; and plan network infrastructure projects and digital inclusion programs. The centerpiece of BroadbandUSA is its technical assistance team, which provides individualized and group technical assistance to state, local, nonprofit, and industry leaders interested in planning, funding, and implementing broadband initiatives. As of June 30, 2017, BroadbandUSA has provided direct, individualized technical assistance to 192 customers in 38 states. More than 60 percent of these communities are considered rural. Overall, through direct technical assistance and workshops, BroadbandUSA has supported more than 800 communities.

BroadbandUSA also ensures that it specifically reaches rural communities and providers through webinars and targeted workshops held around the country. Last year, BroadbandUSA and its partners convened the Digital Northwest Broadband Summit in Seattle and the Big Sky Broadband Workshop in Missoula, Montana. These and other BroadbandUSA workshops typically include rural- and tribal-focused components. This year, our monthly Practical Broadband Conversations webinar series included webinars on economic development, rural broadband adoption, and broadband importance for the agriculture sector. In Fiscal Year 2017, NTIA is also planning to hold technical assistance workshops in Des Moines, Iowa, and Charleston, West Virginia.

NTIA's experience has shown that two of the biggest hurdles facing communities with limited broadband connectivity are planning and funding. NTIA responded to this challenge by developing publicly available tools that give insight into broadband planning, funding and implementation strategies. BroadbandUSA is also developing an online platform to help communities with broadband planning and funding. The platform consists of four modules:

- The **visualize module** will permit communities to see where existing infrastructure is located, overlay this information with their own data and compare it with demographic data.
- The **cost modeling module** will allow communities to identify and better estimate the costs associated with a broadband network.
- The **financial analysis module** will provide communities with the tools to determine if a proposed project is viable and sustainable, including generating pro forma financial statements that they can share with potential investors.
- The fourth module will incorporate the capabilities of the **Broadband Connectivity Assessment Tool (BCAT)**, which provides a framework to assess broadband access and adoption at the local level.

BroadbandUSA is currently beta testing BCAT with fourteen communities, including rural communities from Alabama, Maine and Washington. The scalable cost modeling and mapping tools will enable communities to accelerate broadband planning and shift limited financial resources to implementation.

BroadbandUSA also regularly works with rural industry associations. In addition to these groups, BroadbandUSA works closely with other Federal agencies that fund or support broadband programs, in an effort to improve their efficiency and maximize the impact of these efforts. BroadbandUSA has supported the efforts of several other agencies working in rural areas, including:

- Direct Technical Assistance support to grantees of the U.S. Department of Agriculture (USDA) Stronger Economies Together program, which funds economic development programs in rural areas;
- Technical Assistance collaboration with the Economic Development Administration (EDA), to improve the quality of planning associated with broadband infrastructure projects funded by EDA, alongside other public works programs in rural areas; and
- An outreach initiative with the Office of the Comptroller of the Currency (OCC) intended to inform rural banks and financial institutions about opportunities to support rural broadband programs in the regions in which they operate.

The Department of Commerce and NTIA are committed to working with Congress to advance our nation's infrastructure investment, including fostering broadband deployment, connectivity and adoption, including in rural America.

5. The next two years are critical leading up to the 2020 Decennial Census and require comprehensive end-to-end tests, hiring and training of personnel, and large scale acquisition of equipment. The Census Bureau already significantly reduced the scope of the 2017 census test, including the elimination of critical field activities. This program cannot afford additional shortchanging of critical test plans and remain a successful program that brings both innovation and efficiencies to the Census Bureau. The limited FY 2018 budget details show an inadequate increase over 2017 levels for the Decennial Census, as well as insufficient resources for the entire Bureau. Could you please detail any changes to the 2018 end-to-end test that will result from the proposed FY 2018 budget request?

ANSWER:

The 2018 End-to-End Census Test begins in August 2017 with the address canvassing operation. The plan for the address canvassing portion of the 2018 End-to-End Census Test includes three sites: Bluefield-Beckley-Oak Hill, West Virginia; Providence County, Rhode Island; and Pierce-County Washington. Collectively these three diverse sites will help the Census Bureau gain invaluable experience in conducting the challenging process of building the address list across a wide area of physical geography, housing structures, and residence types.

Following the conclusion of address canvassing operations in early October 2017, the Census Bureau plans to proceed with the remaining operations in scope for the 2018 End-to-End Census Test in Providence County, Rhode Island. Peak operations will commence in March 2018.

Providence County is an ideal community to simulate a microcosm of the 2020 Census experience, as its demographics mirror those of the nation. As such, the Census Bureau remains confident that the 2018 End-to-End Census Test is sufficiently robust to test all of the systems and operations that must be tested.

For the 2018 End-to-End Census Test, the final major field test before the 2020 Census, the Census Bureau has made decisions that will prioritize the readiness and testing of its integrated system-of-systems in the field in a Census-like environment. The lessons learned from how these systems interact with each other, with the operations being tested, and, where relevant, with the field staff and residents in the test sites, will be invaluable to finalizing the operational plan and putting the finishing refinements on the systems in advance of the 2020 Census.

6. Given the increased requirements for the 2020 Decennial Census, the overall budget request for the Census Bureau is lower than required to carry out their mission. Could you provide details on changes needed to comply with lower funding levels across the Census and how it will impact other surveys and programs?

ANSWER:

The FY 2018 budget prioritizes the 2020 Census and the CEDCAP, which supports the 2020 Census. The Department is committed to conducting a high quality Census that implements cost-saving innovations. FY 2018 funds a test of major operations and systems, several 2020 operations including geographic programs, the redistricting data program, the local update of Census addresses and stand up of field and IT infrastructure.

The FY 2018 request reflects decisions to preserve the most critical data products within the Census Bureau's economic and demographic programs, which lead to some tradeoffs that are reflected in the budget. Specifically:

- The data collection process for the American Community Survey will be redesigned, resulting in the elimination of the Computer-Assisted Telephone Interviewing (CATI) nonresponse followup (NRFU) operation, which has proven to be a less effective data-collection mode over time due to the decline of the use of landline telephones and their replacement with mobile devices. To minimize the quality loss, the workload for the Computer-Assisted Personal Visit NRFU operation will be increased slightly. However, at this funding level, the CAPI workload cannot be increased enough to fully offset the loss resulting in reduced data quality for small geographic areas and population groups.

- The mailout of the Economic Census and Census of Governments will be delayed. While the Economic Census and Census of Governments remain on track to release high quality data that will fulfill their primary purpose to provide benchmark data for the monthly, quarterly, and annual economic statistics – including measures of Gross Domestic Product – that are so vital to the functioning of our economy, this delay will ripple through the rest of the cycle for these programs, culminating in the delayed release of the data products. It is important to note that for the economic census, unlike the decennial census, there is no fixed deadline for completion of the data releases.

- The sample for the Survey of Income and Program Participation will be reduced from current levels. The smaller sample affects the statistical power for SIPP data and will limit the ability to produce state-level data. However, the Census Bureau believes that 31,900 households is the minimum sample size that will enable the survey to remain statistically sound and provide information at the national-level on the use and eligibility for government assistance programs, and to provide the economic and social context around income and program participation.

- The Current Economic Statistics programs will reengineer survey operations and scale back on planned research but will continue to release the monthly, quarterly, and annual data on the structure and functioning on our economy that move markets and drive economic growth. Within this level, the Census Bureau will evaluate the potential to redesign the Annual Capital Expenditures Survey and the Business R&D and Innovation Survey to save costs.

7. Intellectual property powers the American economy and drives our trade services surplus. According to the Chamber of Commerce, the IP industries employ more than 1 million people in Washington State and bring $63.9 billion back to Washington State in exports annually. However, foreign theft of American IP remains a critical problem for the more than 40 million Americans employed in IP-intensive sectors. One study found that copyright infringement alone accounts for 24% of global internet bandwidth. The Pro-IP Act of 2008 created the IP Attaché Program to work with foreign governments to address problems just like this.

    a. What are the Department's plans for growing the IP attaché program?

ANSWER:

The USPTO currently has 13 IP attachés around the world who promote strong and balanced protection and effective enforcement of IP rights abroad by directly engaging the foreign governments in the region where they reside.
USPTO's IP attachés are based in Rio de Janeiro, New Delhi, Beijing, Guangzhou, Shanghai, Bangkok, Mexico City, Kuwait City, Brussels, Lima, Kyiv and two attachés in Geneva. A position in Kyiv was recently created to take advantage of new opportunities in Ukraine. All of the IP attachés have regional responsibilities, except for those in China and Geneva. USPTO is currently looking for opportunities to grow the program further in South Africa to enhance IPR protection and enforcement in the Sub-Saharan Africa region and to add an additional position in New Delhi, India.

    b. What is the Department's position on re-designating our IP attaches as Counselors in order to better reflect the responsibilities they shoulder overseas and the importance of IP to US global competitiveness?

ANSWER:

The Department fully supports elevating the diplomatic rank of the IP attachés from their current diplomatic rank as "First Secretary" to the diplomatic rank of "Counselor." Currently, many of the foreign officials in countries where our attaches are based will not meet with an officer at the level of First Secretary. Therefore, the attachés' current rank has limited their effectiveness in certain countries. A rank elevation would allow the attachés to better facilitate international IP policy discussions and engage with more senior host government officials. The rank elevation would also signal that the United States is determined to conduct high-level, sustained engagements on IP rights matters to advance U.S. business interests worldwide.

8. The International Trade Administration's Market Development Cooperator Program (MDCP) has an outstanding record for generating hundreds of millions of dollars in exports with a minimal Federal investment. The purpose of MDCP is to assist small-to-medium size enterprises export US goods, and the MDCP program has benefitted manufacturers throughout the country by removing technical barriers to trade in overseas markets.

   According to the Department, from 1997 through 2015, MDCP projects generated $336 in exports for every $1 of MDCP awards made. The 2016 MDCP recipient programs are expected to generate or preserve more than $359 million in U.S. exports during the next three years in return for the Federal government's $1.3 million investment. Despite these returns on investment, the Department has proposed to eliminate this program.

    a. Why is Commerce proposing to eliminate this program, especially one that has one of the best paybacks in the Federal government?

ANSWER:

The Market Development Cooperator Program (MDCP) has been an effective tool at helping small- and medium-sized firms export. However, due to the funding constraints, MDCP program did not fall within our funding priorities for further continuation.

    b. Can you explain your rationale for eliminating the MDCP?

ANSWER:

Due to the funding constraints, MDCP program did not fall within our funding priorities for further continuation.

    c. What efforts did the Department make to preserve the MDCP?

ANSWER:

Due to the funding constraints, MDCP program did not fall within our funding priorities for further continuation.

d. What is the agency's timeline for shuttering the MDCP?

ANSWER:

Under the proposal, the Department will forego in FY 2018 what had been an annual competition for new MDCP awards. As each competition is launched with an Opportunity Notice published on Grants.gov, ITA would not publish a notice during FY 2018. Existing projects would continue to be supported fully until they expire through FY 2022.

9. Under Section 312(a) of the Magnusson Stevens Fishery Conservation and Management Act (Public Law 94-265) the Secretary of Commerce is authorized to make sums available to be used by State and Tribal Governments which have experienced a commercial fishery failure due to a fishery resource disaster to address the economic and social effects of the failure. Since 2013, there have been twelve commercial fishery disaster declarations approved by the Secretary for salmon and crab fisheries in Washington, Alaska, Oregon, and California. The communities impacted by these disasters, which resulted from changing ocean conditions and habitat loss attributed to climate change, have yet to receive funding from the Secretary to begin to address the social and economic consequences. The budget also proposes the elimination of several core NOAA programs, including the National Sea Grant College, the Pacific Coastal Salmon Recovery Fund, and the National Estuarine Research Reserve, which play a key role in preventing future commercial fishery failures by supporting ongoing efforts to monitor ocean conditions, enhance habitat, and better predict the impacts of climate change on commercial fisheries.
    a. Can you explain why the Fiscal Year (FY) 2018 budget request did not include funding to begin addressing these disasters?

ANSWER:

The Department of Commerce does not have a standing fund for disasters. The President's FY 2018 budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path.

b. Will future budget requests include such funding?

ANSWER:

There is no plan to establish a standing fund for disasters within the five year outyear profile of the President's FY 2018 Budget request.

c. To what degree will the proposed cuts to core NOAA programs included in the FY 2018 request impair the agency's ability to carry out its mission to sustain commercial fishing in federal waters?

ANSWER:

The President's FY 2018 Budget includes funding for the National Marine Fisheries Services and regional fishery management councils to continue priority science and management efforts in support of U.S. fisheries. The agency will continue to work with regional councils and other partners to fulfill our statutory mandates.

10. Our Nation's coasts are cooperatively managed through partnerships between states and the federal government, facilitated by NOAA as authorized by the Coastal Zone Management Act of 1972. The National Coastal Zone Management (CZM) Program provides the foundation for protecting, restoring, and responsibly developing the nation's diverse coastal zone. Currently 34 states participate and have developed management plans that effectively balance competing demands of resource use, economic development, and conservation for the nation's 61,567 miles of coastline. These plans are also key to protecting our national security interests by ensuring critical energy infrastructure and defense installations are protected from vulnerabilities. NOAA provides base funding to support these efforts through its Coastal Zone Management Grants and Regional Coastal Resilience Grants.
    a. Given the importance of these two grant programs, why does the FY 2018 budget proposal seek to eliminate them?

ANSWER:

The President's FY 2018 Budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, some difficult decisions needed to be made, including the decision to terminate this grant program.

b. What consequences do you expect coastal communities to face as a result of the elimination of these programs?

ANSWER:

States and other grantees have used these grants to support a broad range of activities to better position the U.S. to mitigate and respond to flood and storm risks. With the elimination of these grant programs, coastal communities will have to find alternative sources of funding if they choose to continue projects. Despite the elimination of grant funds, NOAA will continue to support states' participation in the National CZM program by supporting implementation of states' management plans, supporting federal consistency reviews, and providing technical assistance services.

c. With respect to the impact that these cuts would have on our national security interests, did you consult with the Sec. of Energy, Sec. of Defense, and/or the Sec. of Homeland Security regarding the potential risks to assets within their jurisdiction prior to proposing these cuts? If so, what responses did you receive? If not, why not?

ANSWER:

The Department of Commerce did not consult with other agencies on the proposed elimination of Coastal Zone Management Grants and Regional Coastal Resilience Grants, and does not believe these cuts present a national security challenge. Additionally, national security implications associated with these programs are most often coordinated at the state level, as coastal zone management grants funds are used to streamline permitting and regulatory processes and to address priority risks with significant economic impacts, including critical infrastructure, commerce, and energy implications.

The Honorable Matt Cartwright

Subcommittee on Commerce, Justice, Science, and Related Agencies

Questions for the Record

Department of Commerce Budget Hearing

Question 1: ECONOMIC DEVELOPMENT ADMINISTRATION (EDA)
In the hearing Secretary Ross, I asked how the administration intended to help historical coal communities across the nation were EDA eliminated. The EDA is responsible for managing the POWER initiative, which focuses resources in these exact communities. I would like to follow up on the Secretary's response with a request for more specifics on the future of the POWER initiative and how it would be funded.

ANSWER:

The Administration's general approach for helping all economically distressed communities, including coal communities, is to boost the entire economy through regulatory reform, unleashing energy resources, addressing unfair trade practices and tax reform.

Question 2: EDA
The Administration's justification for elimination of the EDA and other programs throughout your department is that their functions are duplicated. Can you please provide us with some examples of state and local resources that will provide for:

- necessary investments in sewage lines to allow for the expansion of an industrial park,

- supply chain technical assistance for small and medium sized manufacturers in rural communities,
- and commercialization efforts for research and development conducted by minority and woman owned enterprises?

I would also like to understand what private sector resources will become available should our friends in state and local government be unable to cover the loss of federal support with their own cash-strapped budgets?

ANSWER:

A plethora of State, local and regional programs and initiatives, including foundations and other public-private partnerships, with resources to support these types of development efforts, exists. Moreover, the President's plan to boost the entire economy through regulatory reform, unleashing energy resources, addressing unfair trade practices and tax reform will result in a greater amount of resources for these entities to invest in such efforts.

Question 3: EDA

We can all agree that natural disasters are becoming more frequent. Yet the Stafford Act prevents FEMA from engaging in economic development recovery following a disaster. For years, EDA has filled this crucial role of our disaster recovery framework, addressing the unique issues businesses and communities face in the months and years following a disaster. Can you please share with us how the Administration envisions filling the void left by eliminating the EDA after our next national disaster?

ANSWER:

The Department would work with the Administration and Congress to identify another bureau in Commerce Department or another Federal agency to assume the leadership of the Economic Recovery Support Function of the National Disaster Recovery Framework.

Question 4: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) / Manufacturing Extension Partnership (MEP)

Given that a full 85% of the Department of Defense's awards go to smaller manufacturing firms, I would like to follow up my question from the hearing with a request for more specifics on how exactly the Administration would address the threat to the DoD's manufacturing and readiness needs if the Manufacturing Extension Partnership (MEP) were eliminated.

ANSWER:

The FY 2018 budget prioritizes rebuilding the military, making critical investments in the Nation's security, and providing the savings and efficiencies needed to keep the Nation on a responsible fiscal path. The budget proposed to discontinue federal funding to the MEP program, requiring centers instead to seek future funding from non-federal sources as intended when the program was established. Many difficult decisions were necessary with a limited amount of funding to go around.

Question 5: NIST / MEP
The Administration's proposal for elimination of the MEP, which was recently proven to yield an 8.7-to-1 return to the federal treasury, create and retain more than 86,000 direct jobs and more than 142,000 indirect jobs, and add more than $8 billion to the domestic economy in 2016 alone, is predicated on the assumption that the nationwide network of affiliates will be able to transition to non-federal revenue sources. These affiliates work with small manufacturers – many of which have fewer than 50 employees. They have small technology, innovation, research and development and consulting budgets, need customized solutions and are often in rural communities. The private sector has shown no interest in serving this market. This is evidenced by the fact that over 60% of NIST MEP clients state that their MEP affiliate is their ONLY resource for technical advice. How do you propose those affiliates, which numbered more than 25,000 in 2016, immediately transition to non-federal resources while continuing to serve our smaller, rural manufacturers, which comprise nearly 92% of all domestic manufacturers and together employ over 6.4 million workers? How do we reconcile the Administration's emphasis on making things in America and putting "Made in USA" on more products with the proposed elimination of this critical program?

ANSWER:

The Administration is committed to economic growth and creating American jobs, including manufacturing jobs, through robust regulatory reform, tax reform and better trade deals. In areas where there is demand for services that MEP centers provide, we believe that local MEP Centers may continue to serve manufacturers without additional federal support and that they will transition to non-federal revenue sources, including client fees and partnerships.

Question 6: NIST
According to a November Government Accountability Office (GAO) report, over the last decade, extreme weather cost the federal government more than $320 billion for, among other things, repairs to federal infrastructure. GAO's prior work found that using the best available climate information, including forward-looking projections; can help manage climate-related risks. Federal, state, local, and private decision makers use design standards, building codes, and voluntary certifications in the construction of infrastructure. Standards-developing organizations, such as professional engineering societies, issue standards, model codes, and certifications.

This GAO report recommended that the National Institute of Standards and Technology (NIST), in consultation with the U.S. Global Change Research Program (USGCRP) and the Mitigation Framework Leadership Group (MitFLG), convene an ongoing government wide effort to provide forward-looking climate information to standards organizations.

Can you share how you plan to follow through on GAO's recommendation? What efforts have been undertaken thus far?

ANSWER:

NIST supports efforts to foster greater and more effective participation by federal agencies in the development of voluntary consensus standards.

In view of current budget constraints and Administration priorities, NIST has no immediate operational plans, but as a scientific, non-regulatory, non-oversight agency with the principal mission to advance measurement science, NIST will remain open should there be stakeholder interest in convening to discuss forward-looking climate information for potential use by the standards community.

Question 7: NIST
Previously, NIST conducted important research on plumbing standards. This research helped save water and energy. What resources might NIST devote to such important work in the future?

ANSWER:

NIST has extensive experience and world-class facilities for studying energy use and energy efficiency in buildings. NIST develops and maintains the test methods that characterize the energy efficiency and capacity of water heaters. In addition, NIST uses its Net Zero Energy Residential Test Facility to examine the energy implications of operating hot water heating systems and distributing hot water within the facility. NIST has no plans to update its plumbing research capabilities

Question 8: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
The Administration calls for a 52% decrease in funding for its National Water Model (NWM). With heavy downpours increasing across the nation, the need for accurate and timely flood forecasting is more important than ever. I would like to follow up on the Secretary's answer regarding this question during the briefing with a more specific question. Why was this program, in particular, targeted and given lower priority?

ANSWER:

The President's FY 2018 budget prioritizes many existing programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, NOAA made some difficult decisions, including reducing funding for the National Water Model (NWM). The National Water Model was operationalized in August 2016 and already has greatly improved water forecasting throughout the nation, simulating conditions hourly for 2.7 million locations, up from the previous 4,000 locations every few hours. The Administration has retained resources to maintain existing capabilities and for planned model improvements, but future model upgrades will be delayed.

Question 9: NOAA
The Administration is proposing the complete elimination of NOAA's resilience grants. These grants support coastal planning for floods and sea level rise while increasing the ability of communities to adapt to the realities of climate change. The grants are supported by a dollar for

dollar match with the states. In FY16, States matched more than $59 million. And in 2015 there were a total of $151 million requests, far exceeding the available federal funds. States are struggling, why wouldn't we want to support investments in resilience which gives a return of $4 for every $1 invested?

ANSWER:

The President's FY 2018 Budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, NOAA made some difficult decisions, including the decision to terminate this grant program. NOAA will continue to provide technical assistance to states on coastal resilience issues.

Question 10: NOAA

Similarly, the Administration's budget requests an 82% cut to its Regional Climate Centers (RCC). RCCs have been around for more than 30 years helping local communities to solve real world problems posed by climate change. For example, businesses and farmers across the country rely on RCC data. I would like to follow up on the Secretary's answer from the briefing, with who exactly these state and local service providers are that would fill this significant funding gap?

ANSWER:

The President's FY 2018 Budget prioritizes programs that support national security, public safety, and economic opportunity, while returning the country to a sustainable fiscal path. To meet these goals, NOAA made some difficult decisions to consolidate or eliminate duplicative programs, and prioritize resources to support core functions such as surveys, charting, and fisheries management. NOAA will continue to work through the Regional Climate Service Directors to assist state and local stakeholders to the best of its abilities. Data from NOAA's National Centers for Environmental Information that are tailored by the local Regional Climate Centers (RCC) will remain available for use by emergency service managers, municipal planners, resource managers (i.e., water, agriculture, transportation, etc.) and many others in the private sector that currently work with NOAA's and the local RCC's. For example, some state-funded universities and state climatologists could provide these services, moving forward, with each university or state climatologist focusing on their own state, rather than on the regional level.

Question 11: NOAA

The Administration's budget calls for the elimination of climate-related Arctic research. At a time when we are seeing unprecedented changes in the Arctic, including record-setting loss of sea ice, this research is vital to understanding the implications for native communities, shipping, infrastructure and ecosystems. Recent science also highlights the danger that rising Arctic temperatures could lead to large releases of carbon dioxide currently trapped in permafrost, emissions that would further contribute to climate change. Changes in the Arctic also have significant implications for the US., both because shrinking ice sheets contribute to sea level rise along our coasts (and globally), and because Arctic warming can contribute to changes in the jet stream that contribute to mid-latitude severe weather patterns. How can you justify cutting this research that is needed to better understand and monitor these changes and prepare for the implications for our country?

ANSWER:

The Department's FY18 budget request includes funding to support NOAA's work in the Arctic that deliver on the administration's priorities to support national security, public safety, and promote economic opportunity. These include observations, sea-ice modeling, and surveys conducted by NOAA's National Weather Service (NWS), NESDIS, NOS and the National Marine Fisheries Service, respectively. For example, NOAA will continue to observe the Arctic ocean and atmosphere through satellites, the Integrated Ocean Observing System, and other systems to understand and forecast Arctic change, and conduct annual research and stock assessments in the Bering Sea and in the high Arctic to guide decisions for sustainable management of Alaska/Arctic fisheries and species that are important for subsistence with Alaska Native organizations. NOAA will also support the Administration's Arctic efforts as reflected in Executive Order 13795, Implementing an America-First Offshore Energy Strategy, which aims to put American families and businesses first by encouraging energy exploration and production, including on the Outer Continental Shelf, in order to maintain the Nation's position as a global energy leader and foster energy security, to ensure that any such activity in the Arctic is safe and environmentally responsible.

Question 12: NOAA
Secretary Tillerson recently signed the Fairbanks Declaration at the 10th Ministerial Meeting of the Arctic Council. That declaration, coupled with the 2017 Snow, Water, Ice, Permafrost in the Arctic (SWIPA) report clearly highlight the importance of continued research on the unprecedented changes in the Arctic and its impacts. Why then is the administration seeking to eliminate NOAA's funding for this important work?

ANSWER:

While this budget terminates Arctic research efforts within NOAA's Office of Oceanic and Atmospheric Research (OAR), the Department's FY18 budget request includes funding to support NOAA's work in the Arctic that deliver on the administration's priorities to support national security, public safety, and promote economic opportunity. These include observations, sea-ice modeling, and surveys conducted by NOAA's National Weather Service (NWS), NESDIS, NOS, and the National Marine Fisheries Service, respectively. For example, NOAA will continue to observe the Arctic ocean and atmosphere through satellites, the Integrated Ocean Observing System, and other systems to understand and forecast Arctic change, and conduct annual research and stock assessments in the Bering Sea and in the high Arctic to guide decisions for sustainable management of Alaska/Arctic fisheries and species that are important for subsistence with Alaska Native organizations.

Question 13: CENSUS BUREAU
Director Thompson's departure is further exacerbated by the fact that the deputy director position is also currently vacant. When asked who was temporarily filling the deputy role, the Census Bureau declined to provide a name, saying "The deputy director and director positions at the U.S. Census Bureau will be filled in due course and an acting director position will be filled shortly." The acting deputy director only joined the bureau in December. Prior to that, she had been at the National Oceanic and Atmospheric Administration for more than a decade, rising up to become the acting director of the National Weather Service—also known as the nation's top weather forecaster. But the prospect of this person temporarily leading the agency has worried some census-watchers, who are uncertain about whether her skills as a meteorologist would translate into overseeing the Census Bureau, especially the decennial census.

An additional complication is the relationship of the census to the Commerce Department, its parent agency. Former Commerce Secretary Penny Pritzker elevated the Census Bureau so that its director reports to the deputy director of commerce, bypassing the undersecretary of economic affairs who used to oversee the census. It's unclear if the current administration has retained this organizational structure. But if so, the Census is missing that figure too: the deputy secretary of commerce role also remains unfilled after the initial selection, Chicago Cubs owner Todd Ricketts withdrew in April. The administration has not nominated anyone for the undersecretary of economic affairs role either and the position is being temporarily filled by a civil servant who formerly worked in the finance industry.

Mr. Secretary, it is very concerning that you have not only lost your Director of the Census Bureau since our hearing with him just weeks ago, but you also do not have a deputy director of the Census Bureau or a deputy director for the Commerce Department, who in the past, the Director of the Census Bureau has reported to.

How do you plan to manage these crucial vacancies and how soon can we expect their permanent replacements? As was discussed during the recent Census hearing, there are many concerning factors regarding unpreparedness for upcoming tests, the 2020 Census itself, and a lot of issues regarding cost overruns and underfunding. This is not the time to be without leaders in such vital positions.

ANSWER:

As you may be aware, Karen Dunn Kelly has been confirmed as the Undersecretary for Economic Affairs. The Census Bureau Director reports to her. Regarding the Census Bureau Director, I appreciate John Thompson's service to the Nation as Census Bureau Director. A search is underway for a replacement, and for a permanent replacement for the Census Bureau's Deputy Director. Until permanent successors are appointed or confirmed, I have announced the interim leadership of the U.S. Census Bureau under the Vacancies Reform Act. Ron Jarmin will perform the non-exclusive functions and duties of the Director, and Enrique Lamas will perform the non-exclusive functions and duties of the Deputy Director of the Census.
Ron Jarmin currently serves as the Associate Director for Economic Programs at the U.S. Census Bureau, leading the team for the 2017 Economic Census, which provides the foundation for other key measures of economic performance including the nation's Gross Domestic Product. Starting

his Census Bureau tenure in 1992, Mr. Jarmin has also performed the roles of Assistant Director for Research and Methodology, Chief Economist, and Chief of the Center for Economic Studies. Enrique Lamas currently serves as the Associate Director for Demographic Programs, overseeing the Demographic Programs Directorate which provides accurate information on the size, distribution, and characteristics of the nation's population. Beginning his career in 1980 in the Census' Population Division, Mr. Lamas previously served as Chief of the Population Division, Assistant Division Chief in the Demographic Surveys Division, Chief of the Poverty and Wealth Statistics Branch, and Chief of the Labor Force and Transfer Programs Statistics Branch. Additionally, the 2020 Census program has stable and permanent leadership in place, with Lisa Blumerman serving as Associate Director for Decennial Census Programs, and Deborah Stempowski serving as Chief of the Decennial Census Management Division.

Question 14: CENSUS BUREAU

In addition to these very concerning vacancies in crucial top leadership positions, the President's proposed FY18 budget is sorely underfunded. Please discuss why you apparently feel that your needs are well below historical norms in regards to funding the planned 2018 end-to-end tests.

In the past there have been steep increases in funding in the two years prior to a census to fund testing. Between FY97-98 there was a 101% increase and between FY07-08 there was 61% increase. Yet, the increase between the FY17 appropriated amount and the Administration's request for FY18 is only 2%. How is that enough? How is your request sufficient to fund the 2018 end-to-end test?

If it receives only a negligible increase in funding, it will be impossible for the Bureau to simultaneously maintain regular operations; produce Economic Census data; conclude ongoing research into new operational and enumeration methods; conduct its 2018 End-to-End test; and continue development of its Census Enterprise Data Collection and Processing (CEDCaP) IT system which is now expected to cost over $300 million more than originally projected.

ANSWER:

The FY 2018 budget prioritizes the 2020 Census, including the 2018 End-to-End Census Test and CEDCAP, which supports the 2020 Census. We are committed to conducting a high quality 2020 Census that implements cost-saving innovations. In addition to the End-to-End Census Test, FY 2018 funds several 2020 operations including geographic programs, the redistricting data program, the Local Update of Census Addresses and stand up of field and IT infrastructure.

Additionally, within the FY 2018 funding, the Census Bureau will place several CEDCaP capabilities into production supporting the 2018 End-to-End Census Test. This funding also ensures that the 2020 Census and CEDCaP stay on the critical path to implement the most automated, modern, and dynamic decennial census in history.

Question 15: CENSUS BUREAU

If Congress meets but does not exceed the Administration's FY18 request for the Census Bureau, what previously-planned operations or activities will it forego? What will be the impact of reduced operations in FY18 on the 2018 End-to-End test, decennial Census readiness and projected costs in FY19 and FY20, given that the Government Accountability Office has recently informed Members of Congress that projected cost savings on the decennial Census lifecycle are beginning to erode because preparations haven't been completed as planned? Can the Census Bureau sustain or improve upon the accuracy of the 2010 Census in 2020 with so few resources at this critical juncture in FY18?

ANSWER:

The 2018 Budget reflects what was needed for fiscal year 2018. The Census Bureau is focusing resources on the core areas of innovation and change, and thus higher risk areas as well. The Census Bureau is confident that the resources requested will allow it to successfully test what must be tested ahead of the 2020 Census to help ensure a full, fair, and accurate decennial census.
As I have indicated in my testimony, the Department is currently reviewing the life cycle estimate for the 2020 Census. I will report back to the Committee when I have a number that I am confident accurately estimates both the likely cost of the 2020 Census and a worst-case scenario and what that means for the Census Bureau's funding needs for the rest of the decade.

Question 16: CENSUS BUREAU

The Administration has proposed reducing appropriations for the American Community Survey by just over $4 million. How would this reduction affect the quality of ACS data? Are there regions, counties, or municipalities, or discrete population groups, for which data would no longer be available? How could Congress then assess any such places' or populations' eligibility for federal programs? How would those places suffer in terms of lost economic development opportunities and impaired ability to efficiently manage local government operations?

ANSWER:

In order to manage the FY2018 funding level for the ACS, the data collection process will be redesigned. Specifically, the Census Bureau will eliminate the Computer-Assisted Telephone Interviewing (CATI) nonresponse follow-up (NRFU) operation, which has proven to be a less effective data-collection mode over time due to the decline of the use of landline telephones and their replacement with mobile devices. As a result, a larger percentage of the ACS data will come from the Computer-Assisted Personal Visit (CAPI) nonresponse follow-up operation. To minimize the quality loss, the CAPI workload will be increased slightly to offset some of the loss from the elimination of CATI. However, at this funding level, the workload cannot be increased enough to fully offset the loss resulting in reduced data quality for small geographic areas and population groups.

The design changes described above are expected to result in a 1.5 to 2 percent increase in the variance of survey estimates. The reduction in the quality of the ACS data will affect businesses that use ACS data to determine where to locate their operations and decide what products to put on their shelves; state and local economic development agencies that use ACS data to attract businesses, to make decisions, and to manage growth; first responders who use ACS data to assess impacts and prioritize recovery efforts; and Federal agencies like the Department of Veterans Affairs, which uses ACS data to evaluate the need for health care, education, and employment programs for those who have served in the military. Reduced data quality means that important decisions in both the public and private sector will be made based on less accurate information, which may inhibit effective and efficient outcomes.

The Census Bureau takes this difficult decision very seriously. It knows the value of these data to businesses and communities to make data-driven decisions. However, it also needs to maintain balance within its mission and prioritize what must be accomplished each year.

Question 17: CENSUS BUREAU
In recent testimony to this Committee Census Bureau Director Thompson informed us that development of the CEDCaP system had exceeded projected costs. The system is not scheduled to be fully operational until 2019, so much work remains to be done. The Administration's FY18 budget request provides an increase of less than $10 million over the FY17 appropriated amount for the CEDCaP system. Can you explain how the Bureau will timely complete development of the CEDCaP system given such a modest increase in its funding? Has the date by which you expect the system to be operational changed?

ANSWER:

The CEDCaP program's primary focus in FY 2018 will be to provide capabilities to support the 2020 Census by deploying multiple systems into production to support the End-to-End Census Test. These include several capabilities supporting the Address Canvassing Internet response and field data collection operations. CEDCaP will also provide defect resolution and "bug" fixes to those capabilities to be ready for the 2020 Census. Finally, it will begin testing to ensure that when scaled to the workload of the 2020 Census, the systems function efficiently. The FY 2018 budget request provides sufficient funding for these activities, though some of the work related to scaling the systems for the 2020 Census workload has been deferred to FY 2019. Per the CEDCaP Transition Plan, the high-level operational timeline for the CEDCaP systems for the 2020 Census has not changed.

Question 18: CENSUS BUREAU
Researchers, issue-specific centers, and businesses depend on the availability of accurate and timely statistics from the Decennial Census and the American Community Survey. One cannot study people or groups of people as consumers of products and services, economic agents, health care recipients, or beneficiaries of public programs undergoing evidence-based policy evaluation, without knowing the characteristics and distribution of American households in great enough detail. However, the Administration's FY 2018 budget request, if enacted, will prove a challenge for the Census, which has already suspended several important programs to cut costs. The FY 2017 budget request for Census comes in at $1.5B, below the previous Administration $1.8 budget request. How can this amount be justified to cover the costs leading to and during the 2020 Decennial Census, including the 2018 End-to-End field tests in Rhode Island, Washington, and West Virginia?

ANSWER:

The FY 2018 request supports the most critical operational testing and systems development activities required for the 2020 Census, including 2018 End-to-End Census Test. While, as noted in the budget, two sites are droppcd from the End-to-End test in FY 2018, In FY 2017, the Census Bureau will complete the Census Test for Addrcss Canvassing in these sites. The program can learn what it needs to from the 2018 End to End Test in one site, Providence County, RI.

The FY 2018 request also supports major data collection operations for the 2017 Economic Census and Census of Governments, albeit on a delayed schedule. It is important to note that for these censuses, unlike the decennial census, there is no fixed deadline for completion of data releases. Both censuses are on track to release high quality data that will fulfill their primary purpose to provide benchmark data for the monthly, quarterly, and annual economic statistics – including measures of Gross Domestic Product – that arc so vital to the functioning of our economy.

Finally, the FY 2018 rcquest represents thc outcome of difficult decisions madc balancing fiscal responsibility with preservation of the most important monthly, quarterly, and annual data that drive economic growth, allocation of scarce public funds, and countless other decisions made in both thc public and private sectors. This includes funding the American Community Survey at the full sample of approximately 3.5 million households.

Question 19: CENSUS BUREAU

As you know, the American Community Survey collects data that are either mandated by federal law; or required to implement a federal program, and the ACS is the only source for the data; or required to carry out a federal court order. And yet, since 2012, the House of Representativcs has consistently acceptcd amendments to the CJS bill (via voice vote) to make survey response voluntary, and once (via roll call vote) to eliminate the ACS altogethcr.

a. Sincc Congress itself has asked for the data, what would be the alternativc if we eliminated the ACS, or cut back the survey, or diminished data quality, so that the Census Bureau could not produce data for many arcas, such as rural counties, and small cities and towns, and American Indian reservations and remote areas, and urban neighborhoods?

b. As a business leader, do you believe it is possible for thc business sector to replicate the breadth and depth of data the ACS produces, for every community in the country? Would businesses charge Congress and federal agencies to use the data under this scenario?

c. Likewise, would it be possible for state and local government officials to replicate a dataset similar to the ACS to use for their unique planning and policy purposes?

ANSWER:

The elimination of the American Community Survey would be a loss to our national information infrastructure. There is no alternative that provides the rich detailed data that the ACS produces, especially for rural areas. Losing the ACS would cause far-reaching damage on businesses that use ACS data to determine where to locate their operations and decide what products to put on their shelves; state and local economic development agencies that use ACS data to attract businesses, to make decisions, and to manage growth; first responders who use ACS data to assess impacts and prioritize recovery efforts; and by Federal agencies like the Department of Veterans Affairs, which uses ACS data to evaluate the need for health care, education, and employment programs for those who have served in the military. Finally, Federal agencies are also required to allocate over $400 billion per year in federal funding using data that is only collected by the ACS.

It is difficult to envision the private sector providing the data at levels of detail that the ACS produces, while enabling users to access that data at low or no cost. The ACS serves a number of inherently governmental functions, including providing data that informs distribution of over $400 billion a year in federal funding. The distribution of these funds need to be based on objective and reliable data. Additionally, the confidentiality and privacy of all respondents' personal information must be ensured, and the Census Bureau has built a reputation as protectors of respondent confidentiality and privacy. It is important to avoid concerns about monetizing the collection and securing of these data. Additionally, continued access to ACS data to businesses large and small, new and well-established, ensures that it can continue being a driver of economic growth throughout the private sector.
The Census Bureau knows of no comparable survey that provides the rich level of detail conducted by any state or local government. If state and local governments were to conduct a similar survey, it would only cover those jurisdictions and would likely not provide data that was comparable across the Nation at all geographic levels. Any substitute that would provide comparable data across the Nation at all geographic levels would have to be of the size and scope of the ACS.

Question 20: CENSUS BUREAU
Critics of the American Community Survey complain that the survey is too intrusive and burdensome. What are your views regarding the current structure of the ACS and the steps the Census Bureau has taken in recent years to address ACS respondent burden?

ANSWER:

The ACS covers only those topics necessary to provide for data-driven, efficient decision making by Federal, tribal, state, and local government entities.
The Census Bureau understands that some people find the survey intrusive. Because of that, it is working to create a comfortable experience for our respondents while continuing to administer a survey that remains valuable to governments, communities and businesses. The Census Bureau continues to evaluate and enhance the ACS by improving survey materials and the way we ask questions, reducing follow up contacts, and continuing research into alternate data sources.

For example, beginning in FY2018, the ACS will use three principal modes of data collection -- mail, internet, and Computer Assisted Personal Interview (CAPI). To improve the efficiency of the survey, the ACS will eliminate data collection via the Computer-Assisted Telephone Interviewing (CATI) for nonresponse follow-up (NRFU) operations. As a result of eliminating the CATI NRFU operation, the Census Bureau estimates approximately 10 million fewer telephone calls per year to the ACS respondents, thereby further reducing the respondent burden.

The Census Bureau understands that we live in an ever-changing, data-driven nation. As times change, so does the need to be nimble, flexible, and agile in the Census Bureau's approach to the ACS. Part of this commitment to agility includes actively addressing concerns about respondent burden with the ACS. The Census Bureau is committed to continually investigating and enacting options for survey enhancements, and making research-based changes to how it operates and engages with respondents. The Census Bureau is actively working on numerous efforts to create a positive customer experience while maintaining the high quality of ACS data, and updating our progress in the Agility in Action series. Some of these efforts include:

- Enhancing respondent mail materials,
- Employing alternate data sources,
- Modifying the modes and design of the ACS,
- Ensuring agile design,
- Improving messaging and communication,
- Understanding respondent perceptions of burden, and
- Improving group quarters data collection and products.

The Census Bureau continues to look for additional opportunities to meet our goal of reducing respondent burden and concerns while maintaining survey quality. The ultimate goal remains to field a survey that the public trusts and values.

Question 21: CENSUS BUREAU

In 2003, the Census Bureau, at the behest of Congress, conducted a study, analyzing the feasibility of making participation in the ACS voluntary. The study determined that making the survey voluntary would reduce the response rate by at least 20 percent and increase annual costs by 30 percent ($90 to $100 million more a year). Canada's recent experience with a voluntary census long form generated similar results: the survey's overall response rate dropped from 94 percent to under 69 percent; costs increased $22 million; and low response rates precluded Statistics Canada from producing reliable socio-economic estimates for 25 percent of all areas in the country—mostly small and rural communities. What are your views regarding the mandatory response status of the ACS?

ANSWER:

The Census Bureau has heard the concerns of Congress and members of the public and is actively working to address these and reduce respondent burden. The ACS is mandatory because it is part of the decennial census. The Census Bureau knows response rates suffer when a survey is voluntary and this has a negative impact on the reliability of the data, especially for rural and small communities and small population groups.

When Canada switched a survey similar to the ACS from mandatory to voluntary, Canada lost the ability to publish data for many rural areas. To compensate for a similar effect here, it would cost approximately $90 million more each year to maintain our current data quality.

The Census Bureau's strategy is to convince people to participate by explaining the importance of the data to their community rather focusing on fines or jail time. Although a fine for non-response is established in the U.S. code, the Census Bureau has never asked for the fine to be enforced.

Question 22: CENSUS BUREAU
Is it true that under the Administration's budget two of the three sites (West Virginia and Washington) would be dropped from the 2018 End to End Readiness Test, leaving only the Rhode Island site?

ANSWER:

The 2018 End-to-End Census Test begins in August 2017 with the address canvassing operation. The plan for the address canvassing portion of the 2018 End-to-End Census Test includes three sites: Bluefield-Beckley-Oak Hill, West Virginia; Providence County, Rhode Island; and Pierce-County Washington. Collectively these three diverse sites will help the Census Bureau gain invaluable experience in conducting the challenging process of building the address list across a wide area of physical geography, housing structures, and residence types.
Following the conclusion of address canvassing operations in early October 2017, the Census Bureau plans to proceed with the remaining operations in scope for the 2018 End-to-End Census Test in Providence County, Rhode Island. Peak operations will commence in March 2018. Providence County is an ideal community to simulate a microcosm of the 2020 Census experience, as its demographics mirror those of the nation. As such, the Census Bureau remains confident that the 2018 End-to-End Census Test is sufficiently robust to test all of the systems and operations that must be tested.

For the 2018 End-to-End Census Test, the final major field test before the 2020 Census, the Census Bureau has made decisions that will prioritize the readiness and testing of its integrated system-of-systems in the field in a Census-like environment. The lessons learned from how these systems interact with each other, with the operations being tested, and, where relevant, with the field staff and residents in the test sites, will be invaluable to finalizing the operational plan and putting the finishing refinements on the systems in advance of the 2020 Census.

Question 23: ECONOMICS AND STATISTICS ADMINISTRATION (ESA)
The Administration's initial budget proposal states consolidating the "mission, policy support, and administrative functions of the ESA within the Bureau of Economic Analysis (BEA), the U.S. Census Bureau, and the Department of Commerce's Office of the Secretary." However, the Census Bureau and the Bureau of Economic Analysis (BEA) already are under the Economics and Statistics Administration (ESA) in the Commerce Department's organizational structure.

If the Administration's proposal were adopted, how might the relations of the Census Bureau and BEA to the ESA change? What new role might the Office of the Commerce Secretary play with respect to the Census Bureau and BEA? Does the Administration expect any efficiencies or cost savings to result from this proposal if adopted?

ANSWER:

The President's budget request calls for the functions of the Economics and Statistics Administration (ESA) to be consolidated within the Bureau of Economic Analysis (BEA), the Census Bureau (Census), and the Office of the Secretary. The functions of ESA would be absorbed into these three organizations. ESA is eliminated as an operating unit through this process and BEA and Census will continue to work as collaborative and reliable business partners with no negative impacts related to this change.

The Office of the Secretary of Commerce will continue to be the strategic leader for all Bureau missions. The elimination of ESA will reduce the required appropriation by approximately $4 million and allow for other modest efficiency savings across BEA and Census. Through this effort the department will realize savings in overhead, duplicative expenses, and the relief of a bureaucratic layer within the Department while maintaining activities related to the core mission.

Question 24: INTERNATIONAL TRADE ADMINISTRATION (ITA)
The U.S. Department of Commerce's Market Development Cooperator Program (MDCP) has an outstanding record for generating hundreds of millions of dollars in exports with a minimal Federal investment (approximately $1.5 million annually). Why is Commerce proposing to eliminate this program, especially one that has one of the best paybacks in the Federal government? The MDCP program has benefitted manufacturers throughout the country, and particularly in Pennsylvania, by removing technical barriers to trade in overseas markets. As you know, the entire purpose of this program is to assist small-to-medium size enterprises (SME) export US goods, so the elimination of such an initiative is perplexing.

ANSWER:

The Market Development Cooperator Program (MDCP) has been an effective tool at helping small- and medium-sized firms export. However, due to the funding constraints, MDCP program did not fall within our funding priorities for further continuation.

Question 25: ITA
Technical standards play a decisive role in determining which foreign markets are friendly to U.S. products and services and which markets U.S. exporters face continual technical barriers. Europeans have proven to be very aggressive in ensuring their European technical standards are adopted into regulations throughout the world, which is impeding opportunities for U.S. businesses, particularly small to medium size enterprises. Commerce currently only has 4 Standards Attaches spread across globe. What are its plans to grow the number of Standards Attaché positions and to fill vacant spots?

ANSWER:

Standards Attachés play an important role in helping U.S. companies compete internationally. Commerce has been working to grow support on standards for U.S. business exporters, and is working with the private sector to expand standards efforts. Towards this end, ITA has a standards team that provides training to enable client-facing staff better assist U.S. business clients on standards issues. ITA also tracks standards trends (such as the European Union's effort to spread its standards and regulatory system globally, and China's increasing activism in international standards development) and works to combat market barriers for U.S. exporters. ITA does not have plans to grow the number of Standards Attaché positions at this time.

Question 26: TRADE

Mr. Secretary, I'm sure we agree that when U.S. workers compete on an even playing field they do pretty well. And that one of the central goals of our trade policy should be to even that playing field whenever possible.

We should do this by making sure other countries play by the rules. And we should also negotiate with other countries to make sure their rules are robust and they don't gain a competitive advantage on the backs of their workers and their environment.

The administration has often spoken in generalities about renegotiating trade deals. I believe two areas that can both help the U.S. compete while improving human rights and living conditions around the world are the labor and environmental portions of our trade deals.

NAFTA renegotiations must lead to the strong enforcement of tough labor, wage and environmental standards – as a condition of any new agreement going into effect. Otherwise American firms will continue to relocate to Mexico to maximize profits by dumping industrial waste and paying sweatshop wages.

What is the administration's plan to establish labor and environmental standards – and wage standards – and how will you ensure enforcement – so as to actually make a difference for reducing the deficit and creating American jobs? Specifically, will you seek to integrate the side agreements to NAFTA covering those issues into the main agreement, raise the standards currently in those side agreements, and strengthen their enforceability?

ANSWER:

Ensuring there is a level playing field for U.S. workers around the world is a priority for this Administration and the Department of Commerce. Through the modernization of NAFTA, the President and this Administration have an opportunity to advocate strongly for Pennsylvania's manufacturers and workers. To that end, the Administration has solicited and received input across a variety of channels—from workers, to manufacturers, to Members of Congress—to inform development of the U.S. negotiating position. We fully intend to bring the labor and environment provisions into the core of the Agreement.

Question 27: TRADE

Sticking with NAFTA, since it entered into force, Pennsylvania has lost a substantial amount of its manufacturing jobs. And it's not just my state - manufacturing has taken a hit across the entire

U.S. How will you ensure that NAFTA renegotiations keep the administration's pledge to bring back manufacturing jobs to Pennsylvania and the rest of the country?

ANSWER:

Ensuring there is a level playing field for U.S. workers around the world is a priority for the Administration and the Department of Commerce.

Question 28: TRADE

There has been some talk of the Administration withdrawing from the World Trade Organization (WTO). Is this something that is seriously being considered? What events would precipitate this? What effects do you believe this would have on the economy and our standing internationally?

ANSWER:

I intend to work with Ambassador Lighthizer to ensure that the U.S. participation in the WTO will continue to advance our national economic interests. This includes ensuring other WTO Members are in full compliance with their obligations, and dealing with aspects of the WTO's functions that clearly need attention—judicial over-reach by the Appellate Body being a prime example.

The Honorable Grace Meng

Subcommittee on Commerce, Justice, Science, and Related Agencies

Questions for the Record

Department of Commerce Budget Hearing

1. Scction 6(b) of the United States-Israel Strategic Partnership Act of 2014 required the President to "take steps so that Israel may be included in the list of countries eligible for the strategic trade authorization exception under section 740.20(c)(1) of title 15, Code of Federal Regulations". What steps has the Administration taken to comply with this requirement? What additional steps must occur in order for Israel to secure inclusion on this list of nations eligible for the strategic trade authorization exception referenced above?

ANSWER:

The current policy for eligibility for License Exception Strategic Trade Authorization in 15 CFR 740.21(c) (1) is membership in all four multilateral export control regimes or membership in three of the regimes and NATO. Israel does not meet either criteria.

As the United States and Israel have maintained an enduring security and trade relationship based on shared interests and common values, exports to Israel receive favorable licensing treatment. In addition, the U.S.-Israel Export Control Working Group, chaired by the Department of Defense on the U.S. side with the participation of the Departments of Commerce and State, meets annually to address bilateral export control issue.

2. For all agencies and programs under your jurisdiction, please provide a comprehensive list, for each of the past four years, of all loans, awards, grants, education, training, and other assistance provided to persons or entities in New York's 6th Congressional District.

ANSWER:

This question is applicable to the Department's following agencies and programs:
The United States Patent and Trademark Office (PTO), National Institute of Standards and Technology Manufacturing Extension Partnership (NIST/MEP), International Trade Administration (ITA), and National Oceanic and Atmospheric Administration (NOAA).

The USPTO recognizes New York City as an active hub of innovation, and has dedicated a number of resources to its entrepreneurs and businesses. The agency worked closely with Cornell University as they built Cornell NYC Tech, a graduate level campus located on Roosevelt Island in New York City. The agency currently partners with other local educators in the New York City metropolitan region to provide entrepreneurs with relevant information and resources offered by the Department of Commerce. Since 2013, the USPTO has coordinated or sponsored over 80 events in New York City reaching over 4,000 attendees on educational topics related to intellectual property, innovation, and inventorship. Of note, these have included events with local Small Business Development Centers and the New York City Economic Development Corporation, and joint collaborations with the NYU School of Law and the Cardozo School of Law to host a series of conferences on intellectual property topics.

The USPTO also has a national network of free resources available for innovators, with several locations in New York City. These include a Patent and Trademark Resource Center located at the New York Public Library, where librarians assist in searching for prior art relevant to a patent application, explain the application process to obtain intellectual property rights, and direct entrepreneurs to local patent attorneys who are licensed to practice before the USPTO. In addition, several pro bono programs exist for applicants who qualify financially for assistance: 1) The Pro Bono Program, hosted by New York's Volunteer Lawyers for the Arts, which matches financially under-resourced inventors and small businesses with registered patent attorneys to file and prosecute patent applications; and 2) The Law School Clinic Program, which allows law students enrolled in a participating law school's clinic program to practice Intellectual Property Law before the USPTO under the strict guidance of a Law School Faculty Clinic Supervisor. Fordham University School of Law offers the program for both patents and trademarks, and Brooklyn Law School and New York Law School offer the program for patents.

The Hollings Manufacturing Extension Partnership program (MEP) has served 54 companies through 147 projects in New York's 6th Congressional District over the past four years. The chart below shows the number of companies and the number of projects by year provided by the local MEP Center to the 6th District of New York from 2013 to 2016.

MEP assistance provided to 6th Congressional District in NY		
Year	Number of Companies	Number of Projects
2013	16	33
2014	14	24
2015	11	17
2016	13	19

The information below highlights key areas of the International Trade Administration's work with Rep. Meng's constituents as well as other businesses and stakeholders in New York:

Noteworthy Examples of Assistance - Emerging Technologies and SULA:

Emerging Technologies is a distance learning/business training firm based in Forest Hills, NY. Emerging Tech has been working with ITA/Harlem since late 2015, receiving extensive counseling and market research assistance throughout 2016 and 2017. Emerging Tech used our Initial Market Check service in Brazil in 2016 and continues to work with ITA/Harlem in their additional/new market entry efforts.

SULA NYC Launches New International Branding Strategy
SULA NYC approached ITA in the fall of 2014 for help with their international marketing and branding strategy, and increasing sales through entering new markets. The company was already exporting successfully to Japan, selling into high-end department stores and had opened two SULA NYC spas with support from Japanese investors. However, their US/International SULA NYC website had not received sufficient positive feedback and held them back. Specifically, the company wanted to build off their brand recognition in Japan and enter China but needed to strengthen their website and international marketing strategy to do so.

SULA NYC enrolled in and completed the Cosmetics Industry focused ExporTech program that the New York City and ITA/Harlem offered in the Spring of 2015 in partnership with the New York City Manufacturing Extension Partnership Center, ITAC. Through the program, SULA NYC received in-depth, customized counseling, market research and education on entering additional overseas markets.

Based on insights received during the ExporTech program, the company hired a designer to completely revamp their website, incorporating ExporTech strategies. They relaunched an entirely new website (www.sulanyc.com) and translated marketing materials into Chinese. The company reports it has received great feedback on its revamped website and branding strategy. Their B2B meetings with potential Chinese partners at the China General Chamber of Commerce Forum in September were positive and they received a soft offer for a distribution contract from two Chinese companies.

Sampling of companies assisted in NY-06 congressional district over the last 4 years:

Org Name	Description	Sector	City
Martin Luther High School	Elementary and Secondary Schools	Education	Maspeth
Van Westering Associates	All Other Business Support Services	Other	Forest Hills
New Milestone LLC	All Other Miscellaneous Store Retailers (except Tobacco Stores)	Retail	Elmhurst
Meta Dental Corporated	Dental Equipment and Supplies Manufacturing	Manufacturing	Glendale
North Shore International	Other Miscellaneous Durable Goods Merchant Wholesalers	Retail	Bayside
Bigland Business Inc			Flushing
AEN Technology Solutions	Semiconductor and Related Device Manufacturing	Electronics	Flushing
Caring People Inc.	Home Health Care Services	Healthcare	Forest Hills
MLFSolutions	All Other Support Services	Other	Kew Gardens
Sula NYC LLC	Unclassified Establishments	Other	Forest Hills
Plaza College	Colleges, Universities, and Professional Schools	Education	Forest Hills
A101 Construction+design Inc	New Multifamily Housing Construction (except For-Sale Builders)	Construction	Middle Village
F.M. Brush Co. Inc.	Broom, Brush, and Mop Manufacturing	Manufacturing	Glendale
Cvision Technologies, Inc	Custom Computer Programming Services	Consulting	Forest Hills
Kepco, Inc.	Power, Distribution, and Specialty Transformer Manufacturing	Electronics	Flushing
Airborne Parachute Inc	Other Miscellaneous Durable Goods Merchant Wholesalers	Retail	Flushing
Queens Economic Development Corporation	Marketing Research and Public Opinion Polling	Consulting	Jamaica
Vista Engineering	Engineering Services	Engineering	Flushing
Alliance Computing Solutions, Inc.	Other Technical and Trade Schools	Education	Flushing

Emerging Technologies Institute, Inc.	Business and Secretarial Schools	Education	Forest Hills
Elba	Unclassified Establishments	Other	Flushing

Sampling of Events and Educational Programs with ITA Participation:

- Queens Chamber of Commerce Business Expo, May 17, 2017, Citi Field, Flushing, NY
- Minority Business Development Agency Business Center Launch, Nov. 2016, New York, NY
- Queens Chamber of Commerce Business Expo, May 25, 2016, Citi Field, Flushing, NY
- Queens Chamber of Commerce Business Expo, May 13, 2015, Citi Field, Flushing, NY
- Big Capital "Five Funds Forum" on Impact Investing, March 2015, New York, NY
- Queens Chamber of Commerce Business Expo, May 13, 2014, Citi Field, Flushing, NY
- SBA International Business Expo, March 22, 2013, Queens Crossing, Flushing, NY (Congresswoman Meng was keynote speaker. CS speaker- conducted export seminar)

And finally NOAA (See below). This first list reflects transactions for vendors with a NY address and who specified their Congressional District as 06. Amount is total paid expenses during the time period. Training, education, or other assistance expenses would fall under the Award category.

State	Congressional District	Fiscal Year	Project Description	Affected Document Type	Paid Expenses
NY	06	2013	EPP/MINORITY SERVING INSTITUTIONS	GRANT	$1,147,906.56
NY	06	2013	MANAGEMENT/SUPPORT	AWARD	$100,000.00
NY	06	2013	MARINE SERVICES	AWARD	$9,000.00
NY	06	2013	GRANTS	GRANT	$26,146.32
NY	06	2013	CLIMATE DATA RECORDS	GRANT	$223,973.28
NY	06	2013	EDUCATIONAL PARTNERSHIP PROGRAM	GRANT	$3,661,012.30
NY	06	2013	COMPETITIVE ED GRANTS	GRANT	$454,642.54
NY	06	2013	RESEARCH PROGRAMS-CPPA	GRANT	$4,279.76
NY	06	2013	NAUTICAL CHARTIBN G	AWARD	$28,840.00
NY	06	2013	NE GROUNDFISH COURT-ORDERED OBSERVERS	CONTR	$8,734.08
NY	06	2014	GRANTS	GRANT	$9,971.18
NY	06	2014	CLIMATE DATA RECORDS	GRANT	$103,696.14
NY	06	2014	EDUCATIONAL PARTNERSHIP PROGRAM	GRANT	$1,443,187.70
NY	06	2014	COMPETITIVE ED GRANTS	GRANT	$607,583.46
NY	06	2014	RESEARCH PROGRAMS-CPPA	GRANT	$15,720.24
NY	06	2014	EDUCATIONAL PARTNERSHIP PROGRAM	GRANT	$4,486,107.08
NY	06	2014	BWET CHESAPEAKE NEW	GRANT	$24,769.00
NY	06	2014	COMPETITIVE ED GRANTS	GRANT	$55,337.92
NY	06	2014	RESEARCH PROGRAMS-CPPA	GRANT	$118,503.60
NY	06	2014	NVDS	CONTR	$7,830.00

NY	06	2014	FISHERY-DEPENDENT DATA PROGRAMS	CONTR	$26,277.50
NY	06	2015	GRANTS	GRANT	$1,196.54
NY	06	2015	EDUCATIONAL PARTNERSHIP PROGRAM	GRANT	$414,264.88
NY	06	2015	BWET CHESAPEAKE NEW	GRANT	$49,708.78
NY	06	2015	COMPETITIVE ED GRANTS	GRANT	$111,057.44
NY	06	2015	RESEARCH PROGRAMS-CPPA	GRANT	$74,269.12
NY	06	2015	NEXTGEN	GRANT	$103,391.88
NY	06	2015	EDUCATIONAL PARTNERSHIP PROGRAM	GRANT	$3,306,636.26
NY	06	2015	OESD - EDUCATION PROGRAM	GRANT	$461,876.98
NY	06	2015	EDUCATIONAL PARTNERSHIP PROGRAM	GRANT	$1,154,245.48
NY	06	2015	MAPP	GRANT	$9,502.50
NY	06	2016	EXPAND STOCK ASSESSMENT/DATA COLLECTION	GRANT	$103,414.64
NY	06	2016	NWS NLSC	AWARD	$24,560.00
NY	06	2016	EDUCATIONAL PARTNERSHIP PROGRAM	GRANT	$227,536.18
NY	06	2016	BWET CHESAPEAKE NEW	GRANT	$33,852.64
NY	06	2016	COMPETITIVE ED GRANTS	GRANT	$75,632.36
NY	06	2016	NEXTGEN	GRANT	$56,718.36
NY	06	2016	EDUCATIONAL PARTNERSHIP PROGRAM	GRANT	$1,813,943.66
NY	06	2016	OESD - EDUCATION PROGRAM	GRANT	$314,547.78
NY	06	2016	EDUCATIONAL PARTNERSHIP PROGRAM	GRANT	$3,691,533.68
NY	06	2016	MAPP	GRANT	$123,905.92
NY	06	2016	MAPP	GRANT	$181,371.36
NY	06	2016	NEXRAD SVC LIFE EXTNSN PROJ (SLEP) CWIP	AWARD	$1,553.62
NY	06	2016	JPSS PROGRAM MANAGEMENT (NON-CWIP)	CONTR	$37,356.00
NY	06	2016	NWS NEXRAD RADAR MODS - USAF	AWARD	$6,880.04
NY	06	2016	NWS NEXRAD SPARES - USAF	AWARD	$1,211.94
NY	06	2016	NWS NEXRAD SUPPORT SLEP - FAA	AWARD	$7,773.64
Total					**$24,951,460.34**

This is a list of transactions where the vendor has a NY address but did not specify a Congressional District and could have been in Congressional District 06.

State or Province	Congressional District	Fiscal Year	Vendor Report Name	Affected Document Type	Paid Expenses
NY		2013	EMTEQUE CORP	AWARD	$0.00
NY		2013	EMTEQUE CORP	AWARD	$42,617.68
NY		2013	SOUTHAMPTON, TOWN OF	GRANT	$0.00
NY		2013	SOUTHAMPTON, TOWN OF	GRANT	$1,324,700.00
NY		2013	SANTORA, JARROD A	AWARD	$22,000.00

NY	2013	FRIENDS ROGERS ENVIRONMENTAL	GRANT	$10,000.00
NY	2013	FRIENDS OF ROGERS ENVIRONMETAL	GRANT	$80,000.00
NY	2013	ABERCROMBIE & FISH	AWARD	$0.00
NY	2013	ABERCROMBIE & FISH	AWARD	$6,573.58
NY	2013	RAMCO COMMUNICATIONS INC	AWARD	$1,100.00
NY	2013	BENSON'S SITE SERVICES INC	AWARD	$0.00
NY	2013	BENSON'S SITE SERVICES INC	AWARD	$0.00
NY	2013	APPLICO LLC	AWARD	$12,520.00
NY	2013	2 SEA SONS	AWARD	$15,000.00
NY	2013	ADVISTOR INC.	AWARD	$2,040.00
NY	2013	ADVISTOR INC.	AWARD	$165.00
NY	2013	ADVISTOR INC.	AWARD	$16,800.00
NY	2013	ADVISTOR INC.	AWARD	$12,200.00
NY	2014	EMTEQUE CORP	AWARD	$0.00
NY	2014	EMTEQUE CORP	AWARD	$14,513.04
NY	2014	HOWDEN NORTH AMERICA INC.	AWARD	$0.00
NY	2014	GLOBAL 360, INC.	AWARD	$0.00
NY	2014	2 SEA SONS	AWARD	$0.00
NY	2014	2 SEA SONS	AWARD	$7,725.00
NY	2014	PETER GERARD ASSOCIATES INC	AWARD	$0.00
NY	2014	PETER GERARD ASSOCIATES INC	AWARD	$0.00
NY	2015	EMPIRE PAINTING & HOME IMPROVE	AWARD	$0.00
NY	2015	BENSON'S SITE SERVICES INC	AWARD	$0.00
NY	2015	SERVICE MASTER BUILDING MAINTE	AWARD	$0.00
NY	2015	NEALON, DENNIS	AWARD	$0.00
NY	2015	WARD'S NATURAL SCIENCE ESTABLI	AWARD	$0.00
NY	2016	DOPPLER INNOVATIONS	AWARD	$0.00
NY	2016	ELECTRONIC TECHNOLOGIES CORP U	CONTR	$0.00
Total				**$1,567,954.30**

WEDNESDAY, JUNE 7, 2017.

NATIONAL SCIENCE FOUNDATION

WITNESS

FRANCE CÓRDOVA, DIRECTOR, NATIONAL SCIENCE FOUNDATION

Mr. CULBERSON. The Commerce, Justice, and Science Appropriations Subcommittee will come to order. We are delighted to have with us this morning the Director of the National Science Foundation, Dr. France Córdova. We sincerely appreciate your service to the nation, Dr. Córdova. You have had a distinguished career both in government and academia. We share a common passion for astronomy and astrophysics. I know that is your area of specialty. I am looking forward to hearing you talk to us a little bit today about this most recent extraordinary detection of a third gravitational wave. That is right up your alley.

We have on this subcommittee always enjoyed bipartisan support when it comes to investments in fundamental research at the National Science Foundation and NASA. Everyone on this subcommittee is here because we share a common passion for ensuring that the United States maintains the world's best space program and the world's best fundamental scientific research. When it comes to peer reviewed scientific research, the National Science Foundation does a superb job. And your budget is extraordinarily important as the National Science Foundation represents about 60 percent of the Federal Government's annual investment in basic research that is conducted at U.S. colleges and universities, not including the research that is done by the National Institutes of Health in the extraordinarily important work that they do in fighting cancer and other dreadful diseases.

In many fields the National Science Foundation is the primary source of Federal academic support. May 2017, just this past month, marked the National Science Foundation's 67th anniversary, an extraordinarily important milestone. We are looking forward to more successful discoveries in the future when it comes to understanding the fundamental building blocks of the universe.

In fiscal year 2018, the National Science Foundation is requesting $6.7 billion, which is a decrease of $819 million, or about 11 percent below the current fiscal year. We do not know yet what our subcommittee's allocation is going to be for 2018. The budget process has unavoidably gotten off to a slower start than normal. But the committee is going to work arm in arm to ensure that NSF is appropriately funded and we preserve American leadership in scientific research.

I would like to add that while we wholeheartedly support NSF's basic research in sciences, all of us are mindful of the fact that our constituents' tax dollars very scarce, very precious, and hard-earned. So we are counting on you to be good stewards of that precious resource.

Before we proceed I would like to recognize the gentleman from New York, Mr. Serrano, for any remarks he would like to make.

Mr. SERRANO. Thank you, Mr. Chairman, and thank you, Ms. Córdova, for being with us today. It is good to have you with us today and as the chairman said, you have a distinguished career and much more to come.

The National Science Foundation is vital in promoting basic research and education in science and engineering. In doing so, it is a major source of Federal support for U.S. university research in the STEM fields. NSF's investments in STEM education also help train the next generation of scientists and engineers. As you know, Dr. Córdova, I am a strong supporter of NSF and believe that its programs help our nation be the world leader in major discoveries, innovations, and scientific breakthroughs.

The President's budget blueprint for fiscal year 2018 requests $6.65 billion for NSF, which is an $822 million or 11 percent decrease from 2017. It is the first time in the 67-year history of this agency that a President has proposed a budget below the previous fiscal year. The result is deeply troubling.

Within the total the President's budget also proposes $5.63 billion for the Research and Related Activities Account, which is a cut of $672 million, or 10.6 percent. This level of funding endangers the core missions at NSF. For example, if the requested amount is enacted into law the number of competitive awards for fiscal year 2018 would go down from 11,900 awards per year to 10,800, a reduction of more than 1,000 awards. In a given year NSF grants awards to over 1,800 colleges, universities, and other public and private institutions in 50 states, the District of Columbia, and Puerto Rico. Cutting funding for NSF will leave many schools without much needed education and research funding. I strongly oppose this proposed budget cut.

Another area cut by the President's request is the Educational and Human Resources Account, which is requested at $760.6 million. This represents a cut of $123.5 million or 14 percent. The President's budget proposal accomplishes this by cutting initiatives that increase STEM participation, including programs that help underrepresented minorities. The request also cuts reducing the number of graduate research fellowships by 50 percent. No funding is requested at all for a program that I worked to authorize, the new Hispanic Serving Institutions Program.

Mr. Chairman, I have been a strong support of Hispanic serving institutions and minority serving institutions since I arrived in Congress more than two decades ago. Last year Congress mandated the NSF establish a new HSI program and we appropriated $15 million in the fiscal year 2017 bill for this effort. Notwithstanding the clear evidence that HIS's need this funding, the budget proposal does not fund this program in fiscal year 2018. This negatively affects constituents, by the way, in both Republican and Democratic districts alike.

Another issue of importance to me is the Arecibo Observatory in Puerto Rico. The President's budget for NSF in fiscal year 2018 proposes a total of $7.72 million for the observatory, which is a reduction of $480,000 from 2017. Due to the quality of work taking place at the Arecibo Observatory and the need for maintenance and repairs, I strongly oppose this proposed cut. I know the NSF is currently debating the future of the observatory. But I believe the Federal Government must maintain an adequate level of involvement and support for Arecibo.

Overall the NSF's budget request for this year is an extreme example of the problems with the President's proposal to increase defense spending by $54 billion at the expense of domestic priorities. There is little justification for cutting vital agencies, like NSF, simply to fund a Defense Department already receiving more than half a trillion dollars each year.

The discoveries attained by investing in NSF help our economy grow, sustain our economic competitiveness, and enable us to remain the world leader in innovation. I would note that countries like China are not cutting back on their involvement and investment in the sciences. And unless we shore up the NSF's ability to invest in research, our global leadership in a large number of scientific fields will be threatened. That is a serious national security threat. Unless we have the funding to promote our nation's values beyond defense, our leadership in the sciences is not the only thing that will be threatened.

That you once again, Dr. Córdova, for being with us. And let me just tell you something. You are before a committee that is unique in one way. When it comes to this agency, the chairman and the ranking member agree totally. It is a great agency and it is one that should be funded properly. He has got his limitations with the budget. I have my bully pulpit. I am not chairman right now. I was, and then I had the problems with the budget. But rest assured that we have an interest that is not seen on many other committees where we agree on one agency as much as we agree on this one. Thank you. Thank you, Mr. Chairman.

Mr. CULBERSON. You bet. And Mr. Serrano is exactly right. We are arm in arm. This whole subcommittee is arm in arm when it comes to our support for fundamental research, the spectacular work done by the National Science Foundation and NASA. We are all of us committed to preserving American leadership in fundamental research and in space exploration.

I also want to express my agreement with Mr. Serrano when it comes to Arecibo. We have had previous budgets recommend cutting or reducing, even eliminating Arecibo and we have always stood behind it. It is a national strategic asset. It is a unique radio observatory that has unique capabilities that we simply cannot permit to fall by the wayside. I know you are looking at options about what to do about Arecibo in the future. But Arecibo and Green Bank in West Virginia, we strongly support the preservation of those vital facilities and frankly the expansion of the great work you are doing in astrophysics, whether it be in radio or visible light or in the area I am looking forward to hearing you talk about, the dawn of the era of gravitational wave astronomy. We are looking forward to hearing you talk about that this morning.

We are delighted to have you with us today. We thank you for your service to the nation. Your written testimony will be entered into the record in its entirety, without objection. And at this time we would welcome your brief summary of your testimony. Thank you very much.

STATEMENT OF FRANCE CÓRDOVA

Dr. CÓRDOVA. Thank you, Chairman Culberson, Ranking Member Serrano, and members of the subcommittee. I am very pleased to be here today to discuss the National Science Foundation's budget request for fiscal year 2018. And thank you both for your heartfelt remarks.

NSF is the only Federal agency dedicated to the support of basic research and education across all fields of science and engineering. We support research that enhances our nation's security, drives the U.S. economy, and advances our knowledge to sustain America's technological leadership. And the results of that research enhance the lives of millions of Americans everyday.

The President's NSF budget request for fiscal year 2018 is approximately $6.6 billion, a reduction of over 11 percent from the fiscal year 2017 appropriation.

You already have my full written testimony so I would like to use this time to give some specific examples of how forward looking NSF investments are benefitting the American people.

NSF has long been a leader in information technology research, funding foundational research in computer science, helping to launch the internet, supporting advances in high performance super computers, and investing in cyber security research and education. On the first page of your handout that is in front of you, it looks like this, you will see Dr. Rajkumar of Carnegie Mellon University loading software into an NSF funded self-driving automobile. This research builds on decades of NSF-funded research in precision sensors, computer vision, real time data analytics, and artificial intelligence or AI. Researchers estimate that driverless cars could reduce traffic fatalities by up to 90 percent by mid-century.

NSF-funded AI research also has broad impacts for health. For example, page two of your handout shows Dr. Suchi Saria, Assistant Professor at Johns Hopkins, who recently developed an AI program integrating data from patient health records to identify factors capable of predicting septic shock. Septic shock is a rapid immune response to infection that can cause organ failure, leading to more than 200,000 U.S. deaths annually. Early symptoms are notoriously difficult to spot, but with Dr. Saria's combining and analyzing of numerous health factors her program can accurately predict septic shock 85 percent of the time, often before organs are harmed. Imagine the impact this NSF funded tool will have on people's lives.

These two examples from transportation and health of the power of artificial intelligence and machine learning to transform lives are at the heart of the shaping of the future at the human technology frontier, which is one of our ten big ideas.

Similarly NSF's investment has led to breakthrough manufacturing technologies, as illustrated on page three of your handout. NSF provided critical early support for the techniques behind additive manufacturing, sometimes called 3–D printing, that were discovered and patented during the 1980s and today 3–D printing has become a $5 billion a year industry.

In this image you see Harvard's Jennifer Lewis, who uses materials such as hydrogels, to create architectures that mimic those found in nature, such as bone and spider webs and vascular networks. Such advanced 3–D printing techniques suggest we may soon be able to grow organ replacements using a person's own tissue. Just imagine the lives that will be saved.

Finally, as an astrophysicist myself I cannot resist citing NSF's pivotal role in advancing the era of multi-messenger astrophysics. It is already enhancing our understanding of the universe and revealing its mysteries and is another of NSF's ten big ideas. With ground-based telescopes and particle and gravitational wave observatories in the U.S. and abroad, we are hopeful that some of the biggest discoveries are in reach, unveiling for example the nature of dark energy and dark matter.

Because of the ingenuity of inventors and dreamers such as MIT researcher Nergis Mavalvala, who is shown on page four of your handout, we increasingly have the capabilities to address these profound mysteries. The NSF-funded LIGO facilities detected gravitational waves, which are ripples in the fabric of space time, for the first time in 2015. And just last week, as the chairman referenced, they made a third detection of gravitational waves, this time from a binary black hole source about three billion light years away. Without NSF's consistent funding over the past four decades, we would not have been able to make these kinds of discoveries. It is important to note that these types of projects are made possible because of our country's unique ability to perform complex systems engineering, integrating the talents of scientists and engineers who work together to achieve such results.

Mr. Chairman and members, these are only a few of the thousands of trail-blazing awards that NSF funds every year. On behalf of those talented scientists and engineers and the employees of the National Science Foundation, I would like to thank this subcommittee for its longstanding support of our agency and our continued goal to keep our nation at the very forefront of the global science and engineering enterprise.

And I would like to acknowledge the presence of the National Science Board Chair Maria Zuber and Vice Chair Diane Souvaine in the audience, and I am open to your questions. Thank you.

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

Mr. CULBERSON. Thank you, Dr. Córdova. We wanted to ask about the black hole merger and the gravitational waves. It is a great illustration and, if you could, I would ask you to expand a little bit on the importance of the Congress providing sufficient funding to NSF over a sustained period of time for projects that might not immediately appear to have benefit or gain. The LIGO detection, if you could talk to us about the investment made and what the hope was. Christmas Day of 2015 was the first detection of a gravitational wave and the discovery that was just announced last week is the third detection. How long was the Congress' investment in the Laser Interferometer Gravitational Wave Observatory? And what sum of money was involved? And what significance does that hold for the future, this discovery?

Dr. CÓRDOVA. Well thank you, Mr. Chairman. The NSF has been investing in gravitational wave observing and its potential, for four decades. Since the early nineties we have been funding this particular experiment and more recently an advanced version of it. But integrated over those four decades we have put in $1.1 billion. And significantly our international partners, and there are 14 other countries that participate with us in the LIGO consortium, have put in $400 million. So about $1.5 billion has been invested over a very long period of time.

Much of that money, of course, has gone to observers and students, post-docs, all through that time. And in developing the technology, which as you know this was a huge achievement that Einstein himself when he predicted it now over 100 years ago never thought would be realized because the sensitivity level that needed to be achieved was so very, very great. And he could not envision the kind of technology that would need to be developed to actually detect a gravitational wave. But the scientists and engineers working together did achieve that.

It was a slow progression over a couple of decades to finally get the LIGO facilities to be at the right sensitivity to detect just in time a huge event that happened a billion and a half years ago and then was detected during the first actually engineering run of the LIGO observatory in September of 2015. And then to detect on January 4th the third detection that happened three billion years ago. So we are ready now to observe events that happened billions of years ago.

And the other thing, Mr. Chairman and members, that is so very important about this result, it is not only about achieving an amazing goal and over a long period of time which only the Federal Government can invest in. It is not only about building the kinds of technologies that will have huge spin offs because these are very, if you could look inside the LIGO tubes, the 4-kilometer-long tubes, and see the sophistication of the instrumentation and all that that has entailed over decades to build that and appreciate how impactful those can be in other regimes. But it is also about how we actually identified what those sources of gravitational waves were. They turned out to be something that was totally unexpected.

And that is the whole business of opening up a new window on the universe, it is that you might just see something that you never realized was there before. And in this case, with all three LIGO detections, they are due to binary black holes, which are large in mass, on the order of 20 to 30 solar masses, each component of the black hole. Because they are orbiting each other they are losing angular momentum and eventually they fall into each other and form a single black hole. And when they do that they lose a lot of energy. In the most recent case two solar masses worth; in the first case three solar masses worth. And that is a tremendous amount of energy we cannot even envision. More than the whole universe is putting out is integrated in one instant of time, in just a fraction of a second. And so finding a whole new population of astrophysical phenomena and then thinking about what that could mean for the evolution of the universe is also another tremendous aspect of these discoveries.

Mr. CULBERSON. The first astronomers were using visible light, obviously their eyes, and then telescopes——

Dr. CÓRDOVA. Right.

Mr. CULBERSON [continuing]. Unaware of any electromagnetic radiation outside the visible spectrum. Then we moved into the era of course of radio, infrared astronomy——

Dr. CÓRDOVA. Mm-hmm.

Mr. CULBERSON [continuing]. Ultraviolet astronomy——

Dr. CÓRDOVA. Mm-hmm.

Mr. CULBERSON [continuing]. X-ray astronomy. Talk about the meaning of this new era that we are entering into, the era of gravitational wave astronomy and what it is when you say that the holes merged, very quickly, is a very rapid event.

Dr. CÓRDOVA. Yes.

Mr. CULBERSON. The merger of these holes. This——

VOICE. This is the long one. And this is the shorter one. And now for the increased pitch.

Mr. CULBERSON. That is the first one.

Dr. CÓRDOVA. That is the sound of the universe, yes. That is great. So you have your chirps on your cell phone.

Mr. CULBERSON. Extraordinary. Talk to us about——

Dr. CÓRDOVA. Are you going to make this your ring tone?

Mr. CULBERSON. Yeah.

Mr. CULBERSON. Talk to us about the significance of what we are hearing. We are seeing a very narrow band of——

Dr. CÓRDOVA. Listening to the universe now, which is just great. As you pointed out, Mr. Chairman, we first were investigating the universe through electromagnetic means, all the way from the radio to the x-ray and gamma ray parts of the electromagnetic spectrum. And then we built particle detectors, like the great detector that NSF is involved in at CERN, and the neutrino detectors. We have one called Ice Cube at the South Pole so we can also look at the universe and the high energy particles that come from exotic sources. And now we have opened up a third window, the gravitational window. And as I said, we are observing new phenomena. And yes, you are absolutely correct. That just as the electromagnetic spectrum is very large, embraces a lot of frequencies or wavelengths, so does the gravitational spectrum. And with the particular configuration of the observatories that we have on Earth and their size, we can only observe a narrow portion of that spectrum. So who knows what could be observed, what kinds of phenomenon if we could build larger detectors? And those are certainly under conception in space to observe other parts of the frequency spectrum. And on the ground in explorations at the South Pole we are re-upping and improving the cosmic microwave background detectors so that they can go after identifying what is called the B polarization or polarization from the gravity waves embedded in the microwave background. So that is looking back to the big bang.

So yes, there is a huge amount of spectrum in gravitational waves alone to examine through various means.

Mr. CULBERSON. Well I thank the members for allowing me a little extra time. But the significance of this discovery I do not think can be overstated. And how vital it is for the Congress, for the country, to stand behind NSF and make sure that you have got the support, the financial backing over a sustained period of time to continue to unlock the mysteries of the universe. Because the universe is always more extraordinary than we can even imagine. Thank you very much. Mr. Serrano.

IMPACTS OF REDUCED FUNDING

Mr. SERRANO. Thank you, Mr. Chairman. Fascinating. Now when you get a call it will be the universe calling you. The budget request, Dr. Córdova, we have before us is the deepest cut in NSF history. According to Science Magazine, prior to this year no President, as I said, had ever proposed cutting NSF below its previous year level. Beyond the numbers in terms of dollars, how far does this cut in funding set us back? Can you give us an idea of how many fewer grants will be funded and graduate students trained? Do we endanger our global leadership in the sciences at this level?

Dr. CÓRDOVA. The reduced funding, Congressman Serrano, will of course have an effect because fewer researchers, including students, will receive grants. We estimate that we, with this budget, would have the wherewithal to fund approximately 8,000 grants whereas in our current 2017 budget we can fund 11 or 12 percent more than that. And the public also will have less benefit from the Federal investment in science.

That said, the current budget still has considerable resources and we will do our best to select excellent science to fund using input from the National Academy of Sciences, among others, and relying on the efficacy of our merit review process.

We are used to making difficult choices. Even in the current year we are leaving up to $4 billion worth of excellently funded proposals on the cutting room floor that we simply do not have the funding to make and the fiscal year 2018 budget makes our choices harder. We would see a lower funding rate, with perhaps $5 billion of excellent proposals unfunded.

Mr. SERRANO. Mm-hmm. Let me ask you a question that is on the mind of some people as we look at the 2017 budget. The budget you have proposed for NSF is frankly quite bleak. I along with several of my colleagues here on the subcommittee, I imagine, are interested in making sure that we do not see a cut like this to your budget. After all, it is the Congress who has the final say in funding matters. With that in mind, I am concerned that the NSF may be taking steps to begin reductions now that have been proposed in fiscal year 2018 but not enacted. Can you assure me that fiscal year 2017 funding, which we just completed recently, will not be held back in anticipation of a cut that may or may not come in the future?

Dr. CÓRDOVA. I can assure you that we are not holding back. Our fiscal year 2017 budget was a robust budget for fundamental science and we are not anticipating what the 2018 budget looks like. We very much understand that Congress is in the driver's seat on the fiscal year 2018 budget.

Mr. SERRANO. So we should have no fear that 2017 will be used to cover for 2018 at this point?

Dr. CÓRDOVA. I can assure you that we are not using 2017 to cover for 2018 and we are letting Congress make the decisions about the 2018 budget of course.

Mr. SERRANO. All right. Let me ask you something about the grants. You spoke about the reduction that this budget would reduce or would bring about. Are we seeing an increase in requests for grants? Or has it leveled off?

Dr. CÓRDOVA. We get around 50,000 proposals a year and that number, we are anticipating it could go a little higher, just depending on the situation with all agencies. There are some principal investigators that apply to multiple agencies for their funding. But it is hard to anticipate until we actually see a budget to estimate how many people will apply for grants.

I do know that from going around to universities, I was just at a university yesterday talking with a lot of their faculty, that the funding climate can actually discourage people from applying for grants. So we do not really understand the full consequences of whether we will get more or fewer grant proposals right now. But 50,000 is a lot of grants to manage and we do that well, I think.

Mr. SERRANO. All right. Mr. Chairman, I am at three. So thank you.

Mr. CULBERSON. Thank you, Mr. Serrano. Mr. Jenkins.

GREEN BANK OBSERVATORY

Mr. JENKINS. Thank you, Mr. Chairman. Director Córdova, wonderful to see you. Thank you for our good working relationship over these last couple of years and I enjoyed our phone conversation yesterday. I am glad you made it back safely.

Mr. Chairman, thank you so much for this opportunity. And Director, you and I have had multiple discussions about an asset in my district, Green Bank Observatory, a world class radio observatory. You have mentioned, and the chairman has mentioned, radio astronomy several times. So thank you for your commitment to that. Over these number of years it has received steadfast support from NSF, literally for decades and I appreciate that very much. I do believe it is a key resource for radio astronomy and does contribute significant groundbreaking exploration. And in your testimony you mentioned the important aspects of NSF, such as maintaining global leadership in science and in investing in STEM fields. And I firmly believe, and I think we all would agree, that Green Bank does both.

It gives students hands on experience in STEM at literally every level. And two of the most compelling stories that I have heard over the last couple of years serving in Congress representing this wonderful asset is some of the work that Green Bank's education programs have been doing from students literally from around the world who pursue STEM careers.

What I would like to ask is while I see the budget, as we have talked about, does maintain and support the GBO, the Green Bank Observatory, at level funding for next year, it has been suggested that potentially in the future NSF plans to divest. Can you share with me what the steps of NSF is at this point vis-à-vis this next year and the potential for divestment moving forward, which concerns me greatly?

Dr. CÓRDOVA. So Green Bank is one of the observatories that the National Academy of Sciences, at the beginning of this decade in its decadal report, suggested that in order to do new things, at what was at the time looking at a flat budget scenario, we would have to consider divesting ourselves of some assets. And so a couple of years later, namely in 2012, a portfolio review committee, gathered of astronomers nationwide, recommended that NSF divest itself of the Green Bank telescope, among others.

And so since that time, and that has been reaffirmed in a mid-decadal review as well, that is not saying that it is not doing wonderful science. It is only in order to do new things in a constrained budget that we have to let go of some of the things that we have been doing for a longer time.

So right now we have undergoing an environmental impact study on all of the potential divestments, and the results from the Green Bank environmental impact study that we'll present to the National Science Foundation with options for divestment. Those results should be in by the beginning of the next calendar year, early 2018. We do expect a draft report of the environmental impact study in late August or early September and there will be a 45-day comment period for that.

As you also pointed out in fiscal year 2018 our budget for GBO is approximately the same, even a little bit more, than our fiscal year 2017 estimated budget and that assumes that the ongoing partnerships continue, like the partnership with the Breakthrough Prize Foundation.

Mr. JENKINS. In my 30 seconds I have left let me summarize and make sure I understand. Based on the fiscal year 2017 that we are in, based on the fiscal year 2018 that is before us, we should be safe and sound for the fiscal year 2018 period. We have the EIS study scheduled out early next year, but a draft with public comment may be in the coming months of this year. We have got some hurdles but at least at this point in time with the budget that is before us we should be good for the next year and we will address the issues moving forward after that.

Dr. CÓRDOVA. That is right, Congressman. And I think you also know that NSF is working with others to see what other possibilities there are.

Mr. JENKINS. Yes. Thank you, Mr. Chairman.

Mr. CULBERSON. Thank you, Mr. Jenkins. I recognize Mr. Kilmer.

CYBERSECURITY

Mr. KILMER. Thank you, Mr. Chairman, and thanks for being with us. You know, you touched on it in your opening remarks: the work NSF does around cybersecurity. Your organization has helped advance our cybersecurity efforts and has provided awards to outstanding schools like Tacoma Community College—in my district—that train the next generation of cybersecurity workforce and actually conduct research in this space.

I am concerned about the level of budget cut and what that would mean in terms of NSF's role in regard to our cybersecurity as a nation writ large. To what degree has the administration reviewed the additional risk to local, state, and our federal government, not to mention private industry, if we invest substantially less in cybersecurity?

Dr. CÓRDOVA. All I can talk about is what NSF is trying to do, realizing how important cybersecurity is. I think you know we have a big investment in CyberCorps®: Scholarships for Service, which aims to develop just what you are talking about, a well-educated cybersecurity workforce. And we also have a number of other programs like our Advanced Technical Education program for community colleges to develop the technical workforce.

I think absolutely we understand at the agency that cybersecurity is one of our biggest challenges going forward. There is enormous interest on the part of universities to provide curricula. I was, as I said, at a university yesterday which has developed along with many others a curriculum for involving their students in learning more about computer science so they can produce the cybersecurity workforce for the future. Our Social and Behavioral Sciences Directorate is very, very involved with our Computer and Information Science and Engineering Directorate in encouraging interdisciplinary collaborations of researchers to understand the behavioral practices that are also involved in conjunction with computer practices to provide for a cyber secure world.

Mr. KILMER. Do you think that that progress is going to be eroded based on the cuts that the NSF faces?

Dr. CÓRDOVA. Well, as I said, the reduced funding does present challenges and we have had to make a number of tough choices in our budget. And there will be impacts from reduced funding, yes.

GEO SCIENCE AND EARTH SCIENCE RESEARCH

Mr. KILMER. Let me switch gears and ask about geoscience. Some folks may have read the article about the really big one that could hit on the Cascadia subduction zone, and the impacts that that would have on the West Coast of the United States. We know a lot about the Cascadia subduction zone but there is a bunch that we do not know. That is why the NSF funding grants, like the M9 grant awarded to the University of Washington four years ago, is so vital.

We have heard arguments made that geoscience and earth science research could be funded by other agencies, like NOAA. Unfortunately, within NOAA, the office that is responsible for the bulk of that extramural research is also slated for a cut of more than 30 percent. NASA Earth science is slated for a cut as well. So my question to you is this: If NSF is cutting back in geosciences, and NOAA and NASA are cutting back on research in related fields, who is going to do this?

Dr. CÓRDOVA. We are, as you said, one of the major agencies that is involved in the geosciences and our work that we do, often in conjunction with those other agencies, is extremely important. And I think your question is probably a rhetorical question?

Mr. KILMER. Actually it is not. I actually am curious. Who is going to do the work? I mean, if the funding is being cut by everyone, who is doing this work, and where is it going to happen?

Dr. CÓRDOVA. Well there will be less wherewithal in order to do that important work. We will continue to do the best we can with the budget that we have and subject it to the best merit review processes. And we think that that work is very, very important.

Mr. KILMER. I do, too. I yield back. Thank you.

Mr. CULBERSON. Mr. Kilmer served in the State Senate, I believe, in Washington State. They are very familiar, very familiar with the coastline there, the geology of the area. Is it my memory there was a tremendous tsunami in the 1600s, they found evidence? What was the size of that tsunami? And what effect would that, what kind of an earthquake caused that tsunami, and what would be the effect today, Mr. Kilmer, if you have a similar earthquake and a tsunami of a similar size?

Mr. KILMER. I wish I had a science degree like Dr. Córdova. But the potential, you know, in the article that came out last year I think was definitely not night reading because it suggests that there would be massive devastation. The potential for an earthquake at the Cascadia subduction zone could trigger a very significant tsunami. And that is why I think this research is so important.

Mr. CULBERSON. Yes, I would certainly agree. Thank you. Thank you very much.

Mr. KILMER. Thanks.

Mr. CULBERSON. Mr. Palazzo.

BROADENING PARTICIPATION

Mr. PALAZZO. Well, thank you, Mr. Chairman, and thank you, Director Córdova, for being here today. I echo the comments from my colleagues on the important work the National Science Foundation is doing across the board. Earlier this year I cosponsored the Inspire Women Act, which was a bill that directs NASA to encourage women to study science, technology, engineering, and mathematics and to pursue STEM careers, especially aerospace. That bill passed the House alongside the Promoting Women in Entrepreneurship Act, which authorizes NSF to support STEM entrepreneurial programs aimed at women. As you know, these two bills were among the very first signed into law by President Trump.

I have long been a supporter of STEM programs, especially those geared towards women, not only because I had the privilege of serving as the Chairman for the Space Subcommittee for five years but also because I have a teenaged daughter at home that I hope pursues a STEM field as a career one day.

Your budget proposes calls for providing opportunities and support for those pursuing STEM programs and it aims to produce measurable, sustainable progress geared towards diversity and inclusion. What is your plan on providing these opportunities, especially as it relates to the Inspire Act and Promoting Women in Entrepreneurship Act? And how do you plan on measuring diversity in STEM programs?

Dr. CÓRDOVA. The National Science Foundation is very committed to broadening the participation of women and minorities in STEM. And we have had a lot of programs over time in order to further those goals. One particular one is the ADVANCE Program, for advancing women faculty at universities. I in fact was a PI on that when I was at Purdue University. We have more recently an INCLUDES Program and we are currently funding 40 pilot programs around the United States in order to encourage women and minorities, everyone really, to have more access to STEM careers. And some of these programs are for K through 12, others are for other age groups, and many different disciplines are involved. There is much diversity in the kinds of programs that are being piloted around the country.

All of them have the goal of broadening participation, broadening access to STEM. It is hard to be a STEM entrepreneur without first being STEM literate and then being involved in research and then being inspired to go on and start to be an entrepreneur perhaps in a startup company. And so those pilot programs are going on. INCLUDES is one of our ten big ideas. And they are showing tremendous promise. We will be funding more of those proposals in the fiscal year 2018 budget. We will be forming alliances of groups, because what we really want to do is to scale up this effort so that it connects the whole United States in an effort to make progress in this area. And then more particularly in our SBIR programs, our Small Business Innovative Research programs, where women can actually, can be encouraged and funded to start their own business, we are upping our efforts to reach out to potential prospects and to encourage a larger number of women to want to start their own companies.

Mr. PALAZZO. Well thank you, Director Córdova. And I think promoting women in STEM careers and fields and education is a sound Federal investment. I think you make an outstanding role model for inspiring young women to pursue STEM careers as well. So thank you. I yield back.

Dr. CÓRDOVA. Thank you.

Mr. CULBERSON. Thank you, Mr. Palazzo. Mr. Cartwright.

IMPACTS OF REDUCED FUNDING

Mr. CARTWRIGHT. Thank you, Mr. Chairman. Dr. Córdova, thank you for joining us this morning. And I congratulate you on a stunning career and I wish you all the best in the future.

I am not the first one to say it. The Chairman has said it. My ranking member has said it. This is the first time in the history of the NSF that we are talking about reducing the budget, 11 percent lower than the previous year. I will cut to the chase, that was not your idea, was it?

Dr. CÓRDOVA. The NSF is an executive branch agency of the administration. This is the President's budget.

Mr. CARTWRIGHT. OK. Well NSF of course is wholeheartedly and full throatedly supported by both sides of the aisle here in Congress. It is credited with unimaginable discoveries that have increased social welfare and long term economic benefits. American Sign Language, facial recognition software, fiber optics, and the MRI all have roots from NSF funding to promising researchers at institutions like Penn State, where my district is in Pennsylvania. You know this all too well having worked there yourself. Institutions will be gravely damaged by this budget.

I want to focus on climate change for a moment. Last week the President announced the U.S. withdrawal from the Paris Accord. Although unfortunate it was not unexpected from an administration that denies climate change and denies that human activity has an effect on as the primary cause of climate change. As the head of the Nation's premiere scientific agency, you must have a scientifically informed view on this issue.

I am equally concerned that we might lose our best and brightest, our most talented researchers, to other nations because of these cuts. Just recently French President Emmanuel Macron actually invited American climate change scientists to move to France. You saw that, did you not?

Dr. CÓRDOVA. I heard about it, yes.

RETAINING RESEARCHERS

Mr. CARTWRIGHT. Yes. How does NSF, in this climate, plan to retain our best and our brightest? Our talented researchers, not just on climate science, but in all scientific fields within the U.S. in an environment where we are cutting the budget for the first time ever, this time by 11 percent? How do you keep your best people in this kind of environment?

Dr. CÓRDOVA. I think the budget does, as I said, present impacts and challenges. The budget is not final until Congress weighs in on the budget and I am sure many prospective scientists and engineers are anxiously waiting for how it all unfolds.

Meanwhile, as I also said, we have a lot of money to do good science. We have $6.6 billion proposed and presently we have $7.5 billion. And our goal is to do the very best science that we can and continue to fund researchers that are talented and that are presenting great proposals, continue to invest in them.

We will do everything we can to be more efficient and effective as an agency in order to make those dollars go farther. We will continue to increase our partnerships, and I mentioned partnerships in the context of Green Bank and the context of Arecibo, to leverage the Federal investment. And I will continue to go around the country. And just last night I spoke in D.C. to a lot of very young people and their mentors, about the importance of STEM careers. And I do think that emphasizing broadening participation and welcoming more women and minorities into the fields of science because it is just a terrific thing to do for one's self and for the country, for the world, the future.

FUNDING DETERMINATIONS

Mr. CARTWRIGHT. Not to interrupt, but I want to follow up with another question. There is a movement afoot on Capitol Hill to selectively fund programs at the NSF. You are aware of that, I believe? A movement to pick and choose here in Congress of what programs to fund at NSF.

Dr. CÓRDOVA. Sure.

Mr. CARTWRIGHT. Which I believe would unnecessarily and detrimentally inject politics into questions of what science projects should be funded. How do you feel about that?

Dr. CÓRDOVA. I feel the same way, that the science community is best equipped to set the priorities for science and engineering. We rely on the advice of the National Academy of Sciences and its reports and our advisory groups. And we work with Congress and the administration, of course, to integrate all of those priorities to come up with the very best strategic plan for investment. But I have often said that as the world is changing and evolving; the grand challenges require more disciplines, not fewer, to aggregate around those challenges and to give their best input in solving them. And we found the most effective solutions come from interdisciplinary groups that converge on an important question. We never know where the next discovery is going to come from or who is going to make it. And so it just behooves us to continue to fund, as has been our mandate for these 67 years, all of science and engineering.

Mr. CARTWRIGHT. Thank you, Director Córdova, and I yield back, Mr. Chairman.

Mr. CULBERSON. Thank you, Mr. Cartwright. I am pleased to recognize the gentlewoman from New York, Ms. Meng.

STEM WORKFORCE DEVELOPMENT

Ms. MENG. Thank you, Mr. Chairman, and thank you, Director Córdova, for all your wonderful work. America's economy cannot deliver on its full potential and cannot continue to be great if we do not have STEM workers to fill open STEM jobs. Neglecting to invest in new generations of scientists will only further this problem. Our research shows that STEM fields face persistent and dramatic worker shortages in this country. And for example on the STEM unemployment rate category a study shows from the years 2010 to 2016 unemployment rate within the STEM fields went down from 5.9 percent to 2.7 percent.

So I believe, as I think many of my colleagues do, that at a time when we should be developing STEM expertise and encouraging the pursuit of these advanced degrees we are cutting funding. And by doing this we will be limiting, cutting back on entire generations of scientists. Because those in these fields will be more prone to leave and less students may want to enter into these fields and will have less support if these cuts go through. So how does the NSF intend to deal with consequences of these cuts and the decreasing numbers of people going into these fields in the first place?

Dr. CÓRDOVA. I hope that there is not decreasing numbers of people going into these amazing fields. Because the country really needs them to remain a global leader. And we will do everything we can to promulgate the importance of science and engineering and to fund programs all the way from K through 12, K through my age, for people to get more involved in science and engineering. And we will try to leverage those programs with partnerships from foundations and scientific societies in the private world and industry, which are becoming ever more involved in working with us.

STEM EDUCATION

Ms. MENG. Colleges and students in my district, which is one of the most diverse districts in our country, are now receiving many NSF grant funds supporting STEM faculty training, teacher recruitment, development. These are schools such as Queens College and Queensborough Community College in Queens, New York, York College, and the CUNY system in general. And they have been doing a lot of work in this area. Are you concerned that the NSF budget cuts may decrease effectiveness in terms of NSF's ability to support these important efforts moving forward?

Dr. CÓRDOVA. They are important efforts and by the way, just your mentioning Queens, that is where my mother was born and raised. So it was nice to hear that. But absolutely, the reduced funding will have an effect and fewer researchers will be able to be funded. Yesterday I was in St. Louis at Washington University and one of the things I did was to have a round table with some two dozen young faculty who were CAREER Awardees, which is a very special competitive award that we give. And every time I go to a university I meet with the CAREER Awardees because they represent the bright, up and coming, the people who are going to make the LIGO and other discoveries of the future. And they represented all of the disciplines in science and engineering. And they were so alive with the transformative nature of their research and part of the CAREER Award is that they must also do educational outreach in addition to the research. And they said that doing that education, and it is usually in a school system in K through 12, has transformed even the way they think about their future. So it was very heartening to hear them. As for impacts, a reduced budget does have impact.

Ms. MENG. I too have been having conversations with both private stakeholders and nonprofit organizations who are very concerned about STEM education and want to ensure that they are doing their part to bolster these efforts. So if we could ever have a larger or a further discussion on how to collaborate in light of these potential cuts, I would love to continue this conversation. Thank you. I yield back.

Dr. CÓRDOVA. Thank you.

DANIEL K. INOUYE SOLAR TELESCOPE

Mr. CULBERSON. Thank you very much. All the members of the subcommittee have expressed our strong support for the National Science Foundation and your mission on the importance of continuing the nation's investment in fundamental research. But I wanted to be sure to add because we have an opportunity through our hearing today, Dr. Córdova, to talk to the scientific community at large.

I know that the general sciences here, I see Jeff Mervis, I assume some of the major publications from around the country are here. And the scientific community I hope will join, and my colleagues will join with me and certainly on our side of the aisle to focus the attention of the country on the urgency of bringing down the national deficit, of bringing down the national debt. The fundamental problem that is devouring all of these precious resources that our constituents work so hard to earn, that the 70 cents out of every federal dollar goes out the door immediately, as soon as it comes in, for Social Security, Medicare, Medicaid, veterans benefits, under the Obamacare program, the Affordable Care Act, principal on the debt, and interest on the debt. Seventy cents goes right out the door. And the Appropriations Committee is responsible for that remaining 30 cents. And 15 of the 30 cents goes right out the door to help our men and women in the military ensure that they can fight and win, ideally two battlefronts on two sides of the world. But because of underfunding in previous years for the military, 70 percent of the Marine Corps aircraft cannot fly because of lack of spare parts. Half of our Navy's airplanes cannot fly because of a lack of spare parts. It is an unacceptable situation.

Our military urgently needs a shot in the arm to bring them back up to the level of readiness and preparedness that we expect the United States military to have to ensure that those young men and women come home safely. So we, all of us, have an obligation in educating our constituents, working with our colleagues, to ensure there is enough money for the National Science Foundation, for NASA, for the other critical work in law enforcement, all the important work that the Federal Government does. We have to address the bigger problem of money flying out the door to the programs that are on automatic pilot and devouring our annual Federal spending to such an extent that this subcommittee, the Appropriations Committee is going to be reduced to a smaller and smaller percentage of each one of those Federal dollars. And we just simply cannot pass this massive debt onto our kids.

Donald Trump was elected because the country wanted to see these problems dealt with. They wanted to see the debt resolved, the deficit resolved, spending brought under control, the military restored. They wanted problems solved. And we have got a CEO in the White House who is dealing with these urgent problems and has laid out a budget proposal that we may not agree with all parts of it but fundamentally we have to recognize that our military needs help. We have got to get spending under control in order to make sure that the National Science Foundation has got the help they need.

I encourage the scientific community to do all they can to speak to their members of Congress, their members of the Senate, to focus on the bigger problem. Let us balance the Federal budget, save the looming bankruptcy of Medicare and Social Security, and that will free up a vast amount of money and allow us to get the deficit under control and get back to balance and ultimately pay down that debt so we are not leaving that to our kids. So we have the money to invest in critical work that, expanding the STEM grants for example, is so important; making sure that the tsunami detection network is safe and sound; that you have got the money that you need to invest in really important work like the Daniel K. Inouye Solar Telescope, which has a $20 million line in the budget to continue building this, the world's most powerful solar telescope.

And the total cost I understand for the Daniel Inouye Solar Telescope is about $345 million. Could you talk to us about the current status of the program? Is everything proceeding as planned? And when it comes online in 2020, how will NOAA be able to access the data to fulfill its space weather prediction responsibilities?

Dr. CÓRDOVA. Sure. May I make just a comment related to your remark about the military?

Of course a lot of what the military can use today traces its roots back to science and technology investments, and whether it is GPS or prosthetics and new materials that are used on the battlefield or above it have their roots in science. So we look at science beyond funding a telescope or instruments as really creating a pathway to the future and that has tremendous impacts for all aspects of life, including national security and health, transportation.

So on DKIST, and that is the Daniel K. Inouye Solar Telescope, which will be the world's largest telescope, we expect it to see first light in the middle of 2020, and we welcome any members who would like to see how the telescope is progressing. It is really, besides its promise of being a scientific marvel, it is an engineering marvel.

And I took members of the National Science Board, two of whom are in this audience today, there several months ago and they were just in awe. It is like building, really, a satellite on the ground, but one that has enormous capabilities.

So it is on track to fulfill its promise of having first light very soon. Everything is going very smoothly.

SPACE WEATHER

Mr. CULBERSON. Well, the Space Weather community, have they begun discussions on how this solar telescope can be exploited by both NOAA and NASA to inform their operational or research roles?

Dr. CÓRDOVA. Yes. I don't know the details of that, but could provide them to you. But clearly we advertise that this telescope, because of its incredible sensitivity in observing the sun and magnetic flares, will be very, very useful for Space Weather and Space Weather predictions of substorms and the like from the sun, and those can of course affect the electric power grid.

And so I am quite sure that those discussions with other agencies have already taken place, because the world is really looking to us to have this extraordinary capability to do this.

[The information follows:]

DANIEL K. INOUYE SOLAR TELESCOPE

NSF's DKIST will be the world's most powerful ground-based solar observatory poised to answer fundamental questions regarding the Sun and its magnetic fields. DKIST will be used by scientists to explore the fundamental physics behind the solar magnetic fields that drive phenomena like solar flares, coronal mass ejections, and the solar wind, all of which constitute the space weather that impacts the Earth.

DKIST, however, will not have the cadence or field-of-view capabilities to make it an operational space weather tool for use on a daily basis. This role is better suited to a facility like the NSF's Global Oscillations Network Group (GONG) operated by the National Solar Observatory (NSO). GONG observes the entire disk of the Sun 24/7, 365 days per year from six stations spread around the globe. It is this continuous full-disk coverage that is vital to the space weather prediction models of NOAA, NASA, and the DoD.

Mr. CULBERSON. I am sure the telescope will also help us, for example, understand things like during the, I think it was the Maunder Minimum, it was a little ice age during the Middle Ages, it got very, very, very cold as a result of decreased solar activity, this will help us understand to what extent the cycles of the sun are and the effect they are having on Earth's climate.

Dr. CÓRDOVA. Absolutely, and understand more precisely the physics of the sun and then how that translates into impacting us and Earth.

Mr. CULBERSON. Thank you.

Mr. Serrano.

Mr. SERRANO. Do I understand, Mr. Chairman, that this telescope eventually will be able to look at a State and determine how many people are going to vote Democrat and how many people will vote Republican? [Laughter.]

Dr. CÓRDOVA. Our telescope is——

Mr. SERRANO. It is called the anti-pundit telescope. I couldn't help myself. [Laughter.]

ARECIBO OBSERVATORY

Speaking of telescopes, back to the Arecibo Conservatory and Observatory in Puerto Rico, which is very important to me and obviously to the chairman also.

We know about the reduction; how much have we spent throughout the years to operate, how much did it cost to construct, and what is the research benefits of the facility?

Dr. CÓRDOVA. Well, let me look up my notes here on the costs. It was built by—actually, it was built by ARPA, the precursor of DARPA in the '60s and was completed at a cost of only $9 million. That was in the '60s. And then the transfer to NSF was made in 1969 with us assuming full responsibility a couple of years later.

The operations have cost NSF about $255 million from 1990 through the present fiscal year and total operations costs before that time from 1970 to 1990 we estimate were about $100 million.

As far as the importance of Arecibo, it has been extraordinarily important. Of course, that was where Joe Taylor and Dr. Hulse discovered the binary pulsar, which was the first real evidence of gravitational waves, and it has made many other seminal observations, especially on pulsars, which just happens to be one of my fields. I have been to the telescope and seen the extraordinary observatory.

Mr. SERRANO. I am also concerned about the condition of the observatory with respect to maintenance and modernization. Have any maintenance needs been deferred? Which ones? Could improvements be made to modernize Arecibo and what would that entail?

Because there is a concern, I am hearing, that it is not being taken care of or kept up, because some people believe it is going to go away.

Dr. CÓRDOVA. Well, two major upgrades have been funded, one as long ago as 1974 by NSF and NASA at a cost of $9 million. And there was a 1997 upgrade, funded by again NSF and NASA at a cost of $27 million, which added some powerful things like the Gregorian feed and a more powerful radar transmitter.

Modernization of Arecibo could include new optic elements to allow the telescope to access more of the visible sky, because observations are currently limited to an angle of just 20 degrees from straight overhead. New receivers, upgraded reflector panels and new radar transmitter subsystems. When I asked my group how much all that would cost, they don't have firm estimates yet, but they think it could approach $100 million to do those kinds of upgrades.

Mr. SERRANO. Do you see a desire to continue? I mean, I would like to get to the bottom of this information floating around that in some cases some people say, well, give it away to some universities, which may not be the worst thing in the world, but then there are others who say it is time for it to cease, which should be a warning to other members of this committee, because it may affect how these kinds of things are seen in their districts.

What is your sense of what the scientific or the government community is saying about the observatory?

Dr. CÓRDOVA. NSF's preferred alternative is to collaborate with interested parties for a continued science-focused operation and that is why we put out a solicitation in January of this year to ask others if they were interested in partnering on this telescope. And proposals that are being received in response to the solicitation are currently under review and they will inform us as to next steps.

I go back to my earlier comments that we—and the chairman often asks us just how priorities are set for NSF, we really do rely on the science/engineering communities to inform our strategic planning and that is often done through the Decadal Reports, which actually the astronomy community piloted a number of decades ago. And in this decade's report they have said that we couldn't continue to do everything, if we wanted to do new things, DKIST was mentioned, the LSST, the spectroscopic survey telescope was mentioned, and we couldn't do new things, and all the investment that requires, without letting some things go.

And then we asked the community to assess current assets and what they would divest of. And Arecibo and Green Bank telescope are on that list not because they are not excellent telescopes, they do do great research in particular areas, but there are other telescopes that could have improved resolution over a large what we call phase space in all areas of observing that can provide just simply more capability, and we are in a constrained budget.

So that is where we are with Arecibo.

Mr. SERRANO. Thank you so much.

Thank you, Mr. Chairman.

Mr. CULBERSON. Mr. Jenkins.

GREEN BANK OBSERVATORY

Mr. JENKINS. Thank you, Mr. Chairman.

Director, during our last round right at the end you made reference to collaborations and I would like to explore that for a few more minutes relating to GBO, Green Bank Observatory, and the opportunities and the work that NSF has been undertaking to look for partners in collaborative relationships that may also provide additional funding for maintenance moving forward.

Can you share with me what work your office and the NSF in general has been doing to look for collaborative relationship opportunities, or partners with GBO?

Dr. CÓRDOVA. Yes. Since we started the environmental impact study, we have been on that course, and I have to say I myself have been one of the prime movers in pushing us to look for collaboration and partners. And one potential partnership has turned up recently for Green Bank with the national security community and so we are engaged. I don't want to say too much about it, because it is very new, within the last couple of weeks, few weeks, but those have been very, very long and now sustained discourse with that community over their potential interest in that.

And so we are always hopeful that that will produce something of significance here and we will keep you informed.

ESTABLISHED PROGRAM TO STIMULATE COMPETITIVE RESEARCH

Mr. JENKINS. Well, thank you and I appreciate that. Our office, and I am sure the entire delegation, looks forward to working with you for that. We think there are touch points with not only those interests, but others, NASA, and there are unique opportunities and capacities.

What I think we are trying to do is obviously not only continue to work with the relevance and fulfilling those core NSF missions and functions that you have outlined, but also with other Federal entities and agencies and programs.

So we look forward to working with you. Thank you for your personal interest, as you described engagement in this, very helpful.

One of the areas we are very supportive of is EPSCoR. Back in the 1990s I served on the EPSCoR state board, so this activity is very important. One of the things I do notice from NSF funding is that about 88 percent of your funding goes to about 25 states. I really would encourage some careful consideration about the breadth and the scope and the talents and capabilities of the other 25 states that are now enjoying only about 12 percent of the NSF funding and making sure, candidly, like I do is fight for our fair share in the unique talents and capabilities.

So I just hope that I put a place marker out there of concern that I have about the disparity in the funding allocation. I understand this isn't going to be a pot that is divided in 50 equal ways, but I do believe 25 states getting 88 percent of the funding warrants a careful evaluation of those 25 states that receive 12 percent.

Dr. CÓRDOVA. I hear you, Congressman Jenkins, and clearly the agency feels similarly and that is why we really value the EPSCoR program and we do a great deal. It has had wonderful leadership under Denise Barnes and I think all of us were at, I spoke at that event and you introduced me a couple of years ago, it is just a great and transformative program. And I love going to the EPSCoR states, I went recently to Rhode Island with Senator Reed and just saw the amazing work that they are doing.

So I am very appreciative of your remarks.

Mr. JENKINS. Well, thank you.

Thank you, Mr. Chairman. I yield back.

Mr. CULBERSON. Thank you, Mr. Jenkins.

Mr. Kilmer.

INFRASTRUCTURE AND FACILITY INVESTMENT

Mr. KILMER. Thank you, Chairman.

I know there has been a lot of talk by the current administration about a big infrastructure initiative. I know also that research dollars from NSF don't just go to individual investigators; they support facility investments, including in my neck of the woods at the University of Puget Sound. An NSF major research instrumentation award for a mass spectrometer has made a real difference for faculty and staff and student research.

I am curious, is the NSF involved in the administration's infrastructure initiative and, if not, how could the NSF perhaps be a partner to increase accessibility to science?

Dr. CÓRDOVA. The NSF is very willing to work with the administration and Congress to pursue important investments like that. We know there are many findings from NSF-supported research that can improve infrastructure investments and we have a lot of research on that going on, especially in our engineering directorate.

We hope that investments in scientific infrastructure can be considered and also in cyber-infrastructure as part of the administration's interest in bolstering infrastructure. And so we are very open to collaborations.

We have had some talks with congressional members and their staff about how we are positioned to do increased investments in infrastructure and you mentioned specifically the major research instrumentation program that is so important to our colleges and universities. And of course then we have the large facilities program and we are trying to close the gap in funding with our mid-scale program, which the AICA, a new Act for Competitiveness and Innovation, asks us to do.

So there is just a lot. Infrastructure has been part of what NSF has built its scaffold of amazing discoveries in science and engineering on, and we hope that the entire nation realizes what an important investment that infrastructure is.

NATION'S INVESTMENT IN RESEARCH AND DEVELOPMENT

Mr. KILMER. I also want to ask you, you mentioned the Competitiveness Act, it is rare to get to talk to someone who is NASA's chief scientist. I was thinking, as you came in, about October 4th, 1957, Sputnik. That was a moment in which the United States woke up to an existential threat and as a consequence, the United States, Democrats and Republicans, embraced the notion that to respond to that existential threat required a substantial investment in science. We talked about what could be an existential threat in my neck of the woods, with the geoscience issues of potential earthquakes, but I want to talk about an economic threat.

A few years back, the National Academies worked on Rising Above the Gathering Storm and then the Gathering Storm, Revisited, partnership with a number of CEOs and folks in the scientific community. As you look at their findings, they said first, "The Federal Government funding of R&D as a fraction of GDP has declined by 60 percent since Sputnik," since the response to Sputnik. And then they wrote, "Without a renewed effort to bolster the foundations of our competitiveness, we can expect to lose our privileged position as a nation."

The former CEO of Intel, Paul Otellini, put it this way, he said, "Without a change in U.S. policy, the next big thing will not be invented here, jobs will not be created here, and wealth will not accrue here."

I am curious, do you agree with the findings of the National Academies in the Rising Above the Gathering Storm report and their call for doubling investment in NSF?

Dr. CÓRDOVA. I agree with their findings. As the head of an executive branch agency, I won't comment on their call for doubling the budget of the National Science Foundation.

I gave a little talk yesterday about the existential threat, which is even larger than a lot of people realize, because we have competition from other countries that is incredibly serious.

Mr. KILMER. Yes.

Dr. CÓRDOVA. And that is something that can creep up on you slowly and then all of a sudden you have lost another market, you have lost your premier position, and it has gone somewhere else.

And, frankly, I am concerned about that. I am concerned about the accelerating pace of investments in other countries, I am concerned that we will lose our global leadership if we don't also invest in science and engineering.

Mr. KILMER. I share that concern and I know it puts you in a tough position to have to speak to a budget that calls for a double-digit cut in the work you are doing. So I appreciate you being here.

I yield back.

Mr. CULBERSON. Mr. Cartwright.

CONGRESSIONAL CORRESPONDENCE

Mr. CARTWRIGHT. Thank you, Mr. Chairman.

And thank you for your candor on that last question, Director Córdova.

Director Córdova, we are concerned on this side of the aisle about our ability to get our questions answered under the current administration. My question to you is, has the White House or the Office of Management and Budget approached NSF about any kind of policy or guidance that would prohibit or delay responses to ranking members, that is the head Democrats on congressional committees or subcommittees of jurisdiction?

Dr. CÓRDOVA. There has been no direction that would in any way interfere with the flow of information between NSF and Congress.

We have ourselves at NSF internal processes for answering congressional inquiries that have been in place for years and that haven't changed. We track all incoming and outgoing congressional correspondence, I sign off on that myself, and we try to answer all inquiries as quickly as possible. There is no policy or guidance that would prohibit or delay the flow of information.

RISK AND RESILIENCE

Mr. CARTWRIGHT. Thank you. I am glad to hear that.

Now, we have been talking about climate change and one of the things that I am concerned about are adaptation and resiliency. As NSF's fiscal year 2018 budget states, the Agency-wide Risk and Resilience Initiative, quote, "aims to improve predictability and risk assessment, and to increase preparedness for extreme natural and manmade events to reduce their impact on quality of life, society, and the economy," unquote, but the proposed fiscal year 2018 budget includes a 27.4 percent reduction for the Risk and Resilience Initiative overall.

How would this kind of proposed reduction in funding for this initiative affect the anticipated outcome of improving resilience and readiness of interdependent critical infrastructures?

Dr. CÓRDOVA. You are right that some difficult choices had to be made and that the overall annual budget for Risk and Resilience will be reduced.

Research on hazards in extreme natural events, which is called our PREEVENTS program, will not be affected and will continue to enhance understanding of the fundamental processes underlying geohazards in extreme events on various spatial and temporal scales, as well as the variability inherent in such hazards and events, and improve models for extreme events and their impacts.

But research on resilient infrastructure we have called our CRISP program, an acronym, will be reduced by about 40 percent and impact the number of new awards, and that has been an effort to promote research on interdependent critical infrastructure systems.

So we do plan to invest in both our PREEVENTS and our CRISP program to the tune of about $31 million in Risk and Resilience in the fiscal year 2018 budget. And I know that is a reduction and, again, we had some tough choices to make.

Mr. CARTWRIGHT. Further, the Risk and Resilience Initiative is an NSF-wide investment that has been supported across six NSF directorates and offices. The fiscal year 2018 budget proposes to eliminate funding completely to the Computer and Information Science and Engineering Program, CISE, that is taking away $6 million.

What is the rationale for eliminating funding for this program and how might eliminating the CISE program's funding for this initiative affect efforts across the other directorates?

Dr. CÓRDOVA. Well, I think, again, we will supply you with a more detailed answer for the record, but I think you are talking about the contribution to the programs I just talked about by the CISE directorate, the Computer and Information Science and Engineering directorate. And when I asked all the directorates to look at roughly a ten-percent cut, they all had tough choices to make and on these cross-agency initiatives there were puts and takes.

I think the numbers are what I mentioned for the total effort, which comes from a number of directorates. The size of the computer directorate cutback on that, it means that they made a choice to invest in other initiatives.

[The information follows:]

Risk and Resilience Funding

NSF continues to support the Risk & Resilience (R&R) priority area in FY 2018 through the Prediction and Resilience against Extreme Events (PREEVENTS) and Critical Resilient Interdependent Infrastructure Systems and Processes (CRISP) programs, as well as the science and engineering that underlies innovations in R&R more broadly.

NSF's FY 2018 Budget Request includes $31.15 million for the R&R priority area. Some directorates have decreased their minimum commitment level for the R&R priority area to preserve flexibility within their portfolios. High-quality proposals will nonetheless likely be funded through other ongoing programs that align with the goals of R&R and support fundamental research into R&R-related challenges. For example, although CISE's investment in R&R/CRISP has been reduced in the FY 2018 Budget Request, CISE anticipates supporting related fundamental science and engineering research through other programs:

- As part of the FY 2018 Budget Request, the CISE directorate will lead the cross-directorate Smart & Connected Communities (S&CC) program with participation from EHR, ENG, GEO and SBE. This program will pursue interdisciplinary, integrative research and research capacity-building activities that improve understanding and design of intelligent infrastructure for communities and that lead to enhanced quality of life for residents. This intelligent infrastructure includes critical interdependent infrastructure systems and processes in cities and communities, so it is likely some proposals submitted to S&CC will align with the goals and objectives of CRISP.
- CISE will also continue to lead the cross-directorate Cyber-Physical Systems (CPS) program in partnership with ENG and six other federal agencies. CISE investments in CPS will continue to support foundational interdisciplinary research and education in adaptive and pervasive smart systems supporting a range of applications such as the smart grid, intelligent transportation systems, and medical devices; these, too, are in alignment with the goals of CRISP.

ENG and SBE remain committed to the R&R priority investment through the CRISP program. Engineers and social scientists have decades of experience in jointly examining the resilience of physical infrastructures to natural and technological hazards and extreme events. Research funded through CRISP will continue to integrate engineering and the social/behavioral/economic sciences to provide a deeper understanding of what is meant by infrastructure interdependencies and the associated physical and social phenomena.

The NSF investment in CRISP is expected to be approximately $13M in FY 2018. ENG and SBE currently are developing a plan for the FY 2018 CRISP solicitation, which is likely to include a combination of large research grants, small planning grants, and community engagement and outreach. The FY 2018 CRISP investment also will be responsive to what is learned from the ENG–CISE collaboration on NSF Dear Colleague Letter: Simulated and Synthetic Data for Infrastructure Modeling (SSDIM) (NSF 17-074), as well as to other insights from the CISE community and elsewhere.

Mr. CARTWRIGHT. Thank you, Director.

I yield back, Mr. Chairman.

Mr. CULBERSON. Thank you very much.

Ms. Meng.

Director CÓRDOVA, we will submit the remainder of our questions for the record.

Mr. Serrano, is that——

Mr. SERRANO. Yes.

Mr. CULBERSON. Very good. We will each submit the remainder of our questions for the record.

I want to thank you again for your service to the nation.

Dr. CÓRDOVA. Thank you.

Mr. CULBERSON. And we will stay focused on doing our best to balance the budget as a whole, so we can have more resources for the vital work that the National Science Foundation, NASA, our law enforcement community, and the military all do for the United States.

Thank you very much.

Dr. CÓRDOVA. Great, and thank you.

Mr. CULBERSON. And the hearing is adjourned.

Thank you.

UNITED STATES HOUSE OF REPRESENTATIVES
COMMITTEE ON APPROPRIATIONS
SUBCOMMITTEE ON COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES
Hearing on
National Science Foundation FY 2018 Budget Request

June 7, 2017

Questions for the Record Submitted by John Culberson to

Dr. France Córdova,
Director,
National Science Foundation

NATIONAL INTEREST CRITERIA

Question 1. The *American Innovation and Competitiveness Act* signed into law in January 2017, includes language enhancing national interest standards. It is critical that the American public know that NSF is only funding research that is in the interest of America. Please describe how NSF ensures that each grant awarded is in the national interest.

Answer: NSF's statutory mission is "to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense; and for other purposes". Each NSF award is in the national interest as it reflects the agency's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission. NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects. The decision to fund a proposal is based on three merit review principles[1]:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These broader impacts may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, and are complementary to, the project.
- Meaningful assessment and evaluation of NSF-funded projects should be based on appropriate metrics.

After scientific, technical, and programmatic review and consideration of appropriate factors, the NSF program officer recommends to the cognizant division director whether the proposal should be declined or recommended for award. Sign-off on an award by the cognizant division director indicates that the proposal is in compliance with NSF policies including those regarding the merit review process and certifies that the new project fits within the portfolio of scientific research for which the division has been appropriated federal funds and is aligned with the NSF mission.

[1] Proposal & Award Policies & Procedures Guide (NSF 17-1), Chapter III.A.1: www.nsf.gov/pubs/policydocs/pappg17_1/pappg_3.jsp#IIIA1

DIRECTORATE FUNDING LEVELS

Question 2. Please explain the processes that NSF has implemented to determine funding levels for each directorate.

Answer: The goal of NSF's process is to develop the portfolio of investments that best meets the needs of the Nation. It's a process that takes months of discussion. It engages the National Science Board, incorporates Administration guidance, and addresses requirements established in Congressional legislation. It reflects discussions of emerging areas of science and engineering with NSF's advisory committees and through expert workshops. And, it draws on a wide array of inputs such as studies by the National Academies and decadal reports that set priorities for a discipline. All of this scientific and technical guidance gives NSF a picture of promising longer-term projects, in addition to short-term needs.

The discussions among leadership within NSF are structured so that the directorates work together to identify and pursue the most important priorities and greatest challenges—regardless of discipline. The cooperation among the directorates, especially at the leadership level, is the defining characteristic of the process. This cooperation allows the NSF Director to present a budget motivated by what is best for the science and engineering enterprise.

NSF believes in the process because it fosters cooperation across disciplines, provides flexibility to pursue emerging opportunities, draws fully upon input from the community, best responds to the Nation's needs, and enables the agency to fulfill its responsibilities for strengthening U.S. science and engineering overall, in keeping with NSF's mission.

DANIEL K. INOUYE SOLAR TELESCOPE

Question: Has the space weather community begun discussions about how DKIST can be exploited by both NOAA and NASA to inform their operational and research roles? Given continued fiscal constraints, will DKIST make other ground-based or space-based solar observatory platforms and instruments superfluous?

Answer: NSF's DKIST will be the world's most powerful ground-based solar observatory poised to answer fundamental questions regarding the Sun and its magnetic fields. DKIST will be used by scientists to explore the fundamental physics behind the solar magnetic fields that drive phenomena like solar flares, coronal mass ejections, and the solar wind, all of which constitute the space weather that impacts the Earth. In this role, DKIST is a critical element in satisfying goal 5.5 of the 2015 interagency space weather action plan, "Enhance Fundamental Understanding of Space Weather and its Drivers to Develop and Continually Improve Predictive Models."

DKIST was never intended to have the cadence or field-of-view capabilities to make it an operational space weather tool for use on a daily basis. This role is currently better suited to a facility like NSF's Global Oscillations Network Group (GONG) operated by the National Solar Observatory (NSO). GONG observes the entire disk of the Sun 24/7, 365 days per year from six stations spread around the globe. It is this continuous full-disk coverage that is vital to the space weather prediction models of NOAA, NASA, and the DoD. GONG is thus relevant to goal 5.3 of the2015 interagency space weather action plan, "Establish and Sustain a Baseline Operational Capability for Space-Weather Operations."

DKIST will be a tool available to U.S. solar physicists and space weather researchers by 2020. DKIST currently has a science working group (SWG) led by NSO that is coordinating the various solar research areas the telescope will impact. NSF, NSO, and the DKIST SWG continue to reach out to the space-based solar community to make them aware of the basic research capabilities of DKIST. NSO is sponsoring a series of topic-based workshops to introduce the community to the science capabilities of DKIST. One of these workshops, to be held at the Johns Hopkins University's Applied Physics Lab, is specifically targeted at exploring the synergies between DKIST and upcoming space missions like the ESA/NASA Solar Orbiter and NASA's Parker Solar Probe (previously known as Solar Probe Plus).

DKIST will make the highest-resolution images of the Sun and its magnetic fields ever made, down to a scale of 20-30 km on the Sun. It will have a suite of instruments capable of observing the Sun from the near-ultraviolet, to the visible, all the way into the infrared. In anticipation of DKIST, a 2012 review of the NSF's Division of Astronomical Sciences' portfolio, recommended the divestment of some of NSF's current overlapping user facilities operated by the National Solar Observatory. These assets include the Sacramento Peak Observatory in Sunspot, NM and the McMath-Pierce Solar Telescope at Kitt Peak National Observatory outside Tucson, AZ. While there is still value in these facilities for solar research, education, and training of the next generation of solar scientists, in an era of constrained budgets NSF is seeking to comply with the portfolio review committee's recommendations. NSF is making every effort to partner with the academic community, other government agencies, and the private sector to find suitable partners interested in continuing to operate these facilities.

No space-based assets will become superfluous when DKIST comes on line. No similar space-based capability exists since it is prohibitively expensive to launch a 4-meter class solar telescope with the instrument flexibility and high-resolution capability of DKIST.

SUPERCOMPUTING

Question 4. The NSF FY 2018 budget request includes $60 million to support the acquisition and deployment of a High Performance Computing System. Please describe the current state of supercomputing in the United States. Is the United States leading the world in supercomputing power?

Answer: Over the past six decades, the United States has been the leader in the development, deployment and application of cutting-edge High Performance Computing (HPC) systems. These systems have emerged as unique and critical cyberinfrastructure capable of advancing science and engineering frontiers throughout academia, industry, and government. They possess high levels of computing power, large memories, and high-speed access to large amounts of storage, enabling computational solutions to problems beyond the reach of small- to medium-scale systems and, frequently, beyond the reach of physical experiments. As HPC systems are computing platforms of the highest capabilities, they also embody U.S. technological leadership. Furthermore, the U.S. academic community plays a central and unique role in the achievement of technical, scientific, and engineering breakthroughs through the innovative exploitation of HPC systems in fields such as biology, chemistry, the geosciences, cosmology and astrophysics, atmospheric science, and economics.

The resulting benefits have spurred other nations to dramatically increase their own investments in both the development of competitive HPC technologies as well as the expansion of HPC applications and expertise to solve increasingly complex challenges using multi-spatial numerical models and large-scale data analytics. For example, Japan now supports nine world-class national university HPC centers with both application and hardware expertise; only one system is supplied by a U.S. manufacturer. Similarly, Europe is contributing significantly to HPC application development and has recently committed to having exascale supercomputers based on European technology available for its scientific community by 2022. And after years of dramatically increased hardware investment, China now boasts the top two most powerful HPC systems in the world, and has begun moving to Chinese-based technology from U.S.-based technology for its systems.

In FY 2013, NSF supported the initiation of a two-year National Academies' study to further inform the implementation of its HPC strategy in the 2017 to 2020 timeframe. The final report, *Future Directions for NSF Advanced Computing Infrastructure to Support U.S. Science and Engineering in 2017-2020*,[2] was issued in late April 2016. The recommendations of the report are aimed at achieving four broad goals: (1) positioning the United States for continued leadership in science and engineering, (2) ensuring that resources meet community needs, (3) aiding the scientific community in keeping up with the revolution in computing, and (4) sustaining the infrastructure for advanced computing.

As recommended by the National Academies' study, NSF is taking a holistic approach to enhancing the capacity and capability of the U.S. computational ecosystem. Recent NSF awards supporting HPC resources, software, and infrastructure services:

- Address capabilities beyond the reach of single institutions (e.g., Stampede 2 at the University of Texas at Austin);
- Support new approaches to both simulation and data analytics (e.g., the Bridges supercomputer at Carnegie Mellon University);
- Link computational resources to other parts of infrastructure such as research facilities;
- Encourage collaboration between academia and industry; and
- Complement investments by other federal agencies.

It is critically important that the U.S. continues to enjoy the societal benefits that have resulted from our Nation's long history of leadership in HPC. Maintaining this leadership will only be possible if we continue to invest in the fundamental and multidisciplinary research and education that will form the foundations of tomorrow's computing technology and its effective use. Moreover, given the enormous role that HPC plays in sustaining U.S. research competitiveness across nearly all science and engineering disciplines, it is also critical to invigorate forward-looking cyberinfrastructure and associated research investments to enable transformation of HPC science and engineering software, algorithms, and methods to address new ambitious research agendas while anticipating vastly different platforms in the future.

To this end, and consistent with the recommendations of the National Academies' study, NSF plans a $60.0 million investment in FY 2018 for the acquisition and deployment of a new, more capable HPC system.

[2] www.nap.edu/catalog/21886/future-directions-for-nsf-advanced-computing-infrastructure-to-support-us-science-and-engineering-in-2017-2020

ANTARCTICA INFRASTRUCTURE

Question 5. In 2011, NSF commissioned a blue ribbon panel to assess current U.S. Antarctic Program operations, logistics, and management activities. Please provide an update on the status of the Antarctica modernization program. What are the estimates to complete upgrades at U.S. facilities in Antarctica and what are the timeframes for completion?

Answer: The 2012 Blue Ribbon Panel report made a number of recommendations. NSF has responded to those recommendations by investing about $18 million per year in facilities upgrades. To implement some of the larger scale recommendations towards modernizing McMurdo Station, NSF has developed a potential project: the Antarctic Infrastructure Modernization for Science (AIMS) project. AIMS, once fully developed and funded, would take approximately ten years to complete and would represent a large step in addressing the Panel's recommendations. Cost estimates are under development and will be considered in planning for future budget submissions.

"BIG IDEAS"

Question: One of NSF's "Big Ideas" is the need for a new approach to address mid-scale NSF research infrastructure. What is the estimated cost cap for these activities? Does NSF envision using a decadal survey process to inform the need for and potential missions for these mid-scale infrastructure projects?

Answer: The current estimated cost cap for these activities is $70.0 million, the lower limit of the Major Research Equipment and Facilities Construction budget line for NSF. We do not see the need for a decadal survey process to inform us about the need for these smaller projects. Smaller in scale and often grounded in domain science, decadal surveys and other community-based studies have identified numerous opportunities for mid-scale infrastructure.

THE NATIONAL ECOLOGICAL OBSERVATORY NETWORK (NEON)

Question 6. Please provide an update on the current status of NEON, to include a discussion of the current status of resolving all Inspector General concerns with respect to cost overruns and improper use of management fees. Further, NEON was de-scoped because of potential cost overruns that would have occurred if all of its functionality had been implemented. Will NEON still offer new science?

Answer:
Update on the current status of NEON.

Battelle continues to make significant strides to complete the construction of NEON; overall the Observatory is 85 percent complete. Battelle remains slightly behind relative to their planned schedule. Since permitting issues at several sites are the major contributor to this delay in schedule, both Battelle and NSF continue to allocate resources to guide permitting approvals through the various processes. This slight delay in schedule has not been forecasted to have negative impacts on total project costs; however, NSF continues to closely monitor both schedule and cost, and work with Battelle on mitigation strategies. Based on the most current data available, 56 percent of the Observatory sites/subsystems have transitioned to operations, along with foundational elements of cyber-infrastructure, educational programs, and advanced remote sensing platforms.

Battelle has maintained focus on the increased pace of initial operations while balancing the needs of the Observatory construction efforts. It has continued the project's engagement with both the science and non-science communities through events staged in Boulder and at sites distributed across the Observatory network. The activities engage faculty, students, and the general public, enhancing the local and regional impacts of NEON.

OIG Concerns with Management Fee and Cost Overruns.

Concerning cost overruns, the NSF OIG issued an audit report on September 15, 2015, related to the potential $80 million cost overrun for NEON under the previous management of NEON, Inc. That potential overrun had been identified by NSF, and actions to address the potential overrun had been initiated, prior to issuance of the OIG report. The OIG subsequently closed the recommendations in that report on May 11, 2016, based upon corrective actions taken by NSF and the Agency's replacement of NEON, Inc., in Spring 2016, with Battelle as NEON's management company. No cost overruns under the newly scoped construction award are anticipated as verified through current Earned Value Management (EVM) data.

Specific to the use of fees under the NEON award, the NSF OIG conducted an audit of management fee expenditures by NEON, Inc., the former awardee responsible for overseeing the NEON project. The time period audited, October 1, 2011 to September 30, 2014, preceded the implementation of NSF's formal Management Fee policy in 2015. The OIG closed the audit on April 5, 2017, based upon NSF's response to the recommendations contained in the audit, which demonstrated that NSF has implemented responsive corrective actions for awarding and monitoring management fee specific to NEON and to large facility awardees in general. More recently, the NSF OIG issued an audit report on May 12, 2017, "NSF Needs Stronger Controls Over Battelle Memorial Institute Award for the National Ecological Observatory Network." The report included several recommendations concerning fees being received by Battelle. NSF has agreed with three of the four recommendations, and in fact these issues had already been addressed to a large degree prior to the issuance of the report. They include ensuring that fees are paid as a specific amount and not as a percentage of cost, including an acceptable draw down schedule for a fee, and finalizing fee amounts for construction and operations in a timely manner. There is also one OIG recommendation that NSF does not agree with—that NSF disallow Battelle's use of its management fee for charitable contributions. Not allowing Battelle to use a portion of its fee for charitable purposes would be inconsistent with the organization's status as a non-profit charitable trust, and would also be inconsistent with NSF's goal of ensuring sufficient fee is provided, when appropriate, to incentivize highly qualified organizations to compete for NSF major facility awards. This last matter has yet to be resolved with the OIG.

Will NEON still offer new science?

Yes, NEON will still offer new science.

NEON was designed to enable researchers to answer cutting edge ecological questions by providing them a suite of biotic and abiotic variables collected consistently over spatial and temporal scales not previously sampled. Variables are to be measured at frequencies that the community deems useful and informative at the targeted scale. Across the NEON infrastructure, physical components, sampling methods, and measurements are standardized to increase the utility and comparability across the scales needed by the research community. NEON's cyberinfrastructure provides computational resources for delivering a range of data products based on the in-situ, observational and remote sensing data components, serving as the platform that allows NEON users to detect patterns, and make predictions against seamless, reliable regional and continental scale data layers. The project is still positioned to deliver on these goals.

Following the de-scoping of construction in July 2015, the operations and maintenance (O&M) plan was realigned around 81 sites across the twenty domains: 47 terrestrial sites (20 core and 27 relocatable) and 34 aquatic sites (20 core and 14 relocatable), deployed across the continental U.S., Alaska, Hawaii, and Puerto Rico using a statistically determined design. In a letter to the community released in September 2015, the current president and 15 past presidents of the Ecological Society of America stated that despite the de-scoping, they "remain excited about the potential new science that could emerge from successful NEON" and "believe successful NEON could generate valuable data to help address problems that currently challenge the very fabric of society and the biosphere that sustains it."[3] A similar assessment was made by a subcommittee of the BIO Advisory Committee when evaluating impact of the 2015 de-scope on the science that NEON would inform.[4] Despite the de-scope, NEON still remains the only facility that is designed to employ standardized protocols and provide data at this spatial and temporal scale. Additionally, the final operations schedule will be designed to maximize and leverage the exploration of new science initiatives by the community. NSF therefore has great confidence that NEON will still deliver new and potentially transformative science.

AWARDEE MISCONDUCT, REPRODUCIBILITY IN SCIENTIFIC RESEARCH

Question 7. A quote from the NSF IG's September 2016 Semiannual Report to Congress states, "In recent years, we have seen a significant rise in the number of substantive allegations of research misconduct associated with NSF proposals and awards." An April 2017, Science article also discussed research integrity and reproducible research. To address some of these issues, earlier this year NSF proactively convened a workshop, "Robustness, Reliability, and Reproducibility in Scientific Research." Please provide highlights of this report and the path forward for NSF to address some of these concerns.

Answer: The NSF IG's March 2017 Semiannual Report to Congress provides multi-year data summaries of allegations of research misconduct that do not demonstrate, based on the numbers provided, a significant rise in the number of allegations. See pp. 26-27 of the NSF IG's March 2017 Semiannual Report[5]. The OIG further qualified this data by stating that "one cannot make a meaningful comparison or identify trends related to allegations across the entire reporting period" because "[it] we used three different methods of capturing allegation data." See pp. 26 (fn. 35) of the NSF IG's March 2017 Semiannual Report.

The February, 2017 NSF workshop "A Systematic Approach to Robustness, Reliability, and Reproducibility in Scientific Research" addressed four major themes:
1. Lack of Reproducibility in Experimental Data: Is this a Feature or a Flaw?
2. The Role of Theory and Experiment in Science;
3. Precision, Statistics and Software; and
4. Fundamentals of Scientific Reporting.

Overall, the workshop concluded there is an inherent uncertainty in scientific research, where errors do occur and that the severity of the issue can be dependent on the scientific field. The

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[3] www.esa.org/esablog/guest-posts/esa-presidents-comment-on-neon-de-scoping/
[4] www.nsf.gov/bio/advisory.jsp
[5] www.nsf.gov/oig/_pdf/OIG_SAR_317.pdf

report also states, "The scientific process is well suited to ensure that these errors are corrected, though this may take time; moreover, this lack of reproducibility can lead to new insights and discovery as inconsistencies are explored and resolved."

The report[6] states the following short conclusions (on page two), community priorities, and recommended future actions:

Workshop short conclusions

- Variability in research results is an essential component of the scientific process. Exploration of such variabilities can shed light on previously unrecognized variables and yield improved understanding of the natural world.
- There are significant differences in the amount of variability in scientific results from field to field. Fields with higher levels of variability tend to be less mature, so that there are more unrecognized variables that can affect results.
- Scientific fields that are more mature do not suffer from problems in reproducibility and replicability. Instead variability in results is part of the natural scientific process and often leads to new discoveries.
- Scientific fields that are not as mature can be subject to some problems. These are best addressed through full reporting of all data. Tools for reporting and retaining scientific results have substantially improved over the past ten years. Improvements in transparency of published data also increase reliability and reproducibility.
- There is considerable value in communicating with the public about the nature of the scientific process, and its robustness in self-correcting results that are irreproducible.

A synopsis of workshop suggested future actions and activities are:

- Training: Continue support for community-specific workshops and summer schools to promote effective practices in the area of robustness, reliability, and reproducibility in scientific research.
- Software Robustness: Directorate partnerships with CISE to identify opportunities for Research Coordination Networks (RCNs) in computational and data-enabled science.
- Transparency: Integrate with on-going activities regarding the public access to results from NSF-supported research.

With respect to building a path forward, NSF—in partnership with other stakeholders in the scientific enterprise, including academic institutions, journal editors, scientific societies, and the investigator community—is pursuing actions and activities that promote robust and reliable scientific research.

First, NSF is addressing issues of robust and reliable science at both the Agency-wide level and within all directorates through jointly sponsored public symposia and workshops, NSF Research Traineeships, review of data management plans in research awards, and research on robust and reliable sciences. Specifically,

- SBE issued DCL 16-137 seeking proposals for research and other activities to that enhance and inform the robustness and reliability of research in the social, behavioral, and economic sciences.
- CISE issued DCL 17-022 encouraging the submission of proposals to that improve the level of reproducibility in research on computer systems and networking; modeling, analysis and simulation of computing and communication systems; and cybersecurity.

[6] www.mrsec.harvard.edu/2017NSFReliability/cw/report.php

- GEO issued DCL 16-083 welcoming proposals related to enhancing the validity of the data and outcomes of research in all GEO programs.
- MPS will host a "NSF-Wide Workshop to Explore the Prospects for a Common Response to the Requirements for Public Access to Research Data". This workshop, planned for Fall 2017, will bring PIs of all community workshops sponsored by NSF in response to the 2013 OSTP Memo calling for "Increasing Access to the Results of Federally Funded Scientific Research."
- MPS funds the MPS Open Data Workshop Series[7], an effort organized by Mike Hildreth (University of Notre Dame), the lead of the DASPOS: Data and Software Preservation for Open Science[8] project.

Secondly, we should mention that while the observed variability is most often the nature of complex unchartered systems and not necessarily related to unethical research, NSF has taken concrete steps to enhance the awareness of ethical conduct of research issues by NSF staff, as well as the U.S. and international scientific research and education communities, by supporting the development of tools and resources to enhance the ability of research institutions to cultivate cultures of academic and research integrity. The Online Ethics Center (OEC) provides resources, including an Ethics Education Library that institutions can use to deliver effective training that is tailored to meet the needs of their particular project. In addition, NSF continues to support the Cultivating Cultures for Ethical STEM (CCE STEM) program, which invests in innovative approaches to enhance research into ethical conduct of research issues that can build the capacity of institutions to develop appropriate ethical conduct of research plans as required by the America COMPETES Act.

NSF FUNDING REDUCTION

Question 8. The National Science Foundation's (NSF) role is to promote fundamental R&D and education in science and engineering. The lions-share of NSF funding goes to colleges and universities across the country through competitive merit-based projects. NSF funds research of the physical sciences critical to advancing optics and photonics - the science and application of light - that underpin current and next generation technologies across US economic sectors including defense, communications, energy, manufacturing and health and medicine. The President's FY 2018 budget proposes to cut NSF's basic science program by 13% to $4.3 billion. With our nation's economic future dependent upon continued science and technology advancements, please explain the rationale for cutting NSF funding.

Answer: The President's FY 2018 Budget Request includes a reprioritization of federal spending that reflects the Administration's emphasis on the safety and security of the American people. The NSF request nonetheless demonstrates the agency's ongoing commitment to the support of basic research and education across all fields of science and engineering and the establishment of clear priorities in areas of national importance. NSF will continue to fund basic research that pushes the boundaries of innovation, lays the groundwork for scientific breakthroughs that advance the Nation's economy, security, and global leadership, and helps to prepare future generations of scientists and engineers.

[7] http://mpsopendata.crc.nd.edu/
[8] https://daspos.crc.nd.edu/

Questions for the Record Submitted by Robert B. Aderholt

PROPOSAL RESPONSE TIMES

It is my understanding that NSF has periodically issued Requests for Proposals with limited time for proposal development, especially for faculty who have research, teaching, and service responsibilities. More time to develop proposals would allow for more diverse involvement in our nation's science enterprise, allow for investigators to discuss their ideas with NSF Program Managers, and allow for better quality proposals being delivered to the NSF.

Question 1. For each of the last three years, what is the average number of days between the date that the Request for Proposals are announced, and the proposal due date?

Answer: Internal NSF policies in the Proposal and Award Manual (PAM) state that "public notice must be given for new funding opportunities to allow adequate time for NSF competition and proposal preparation, as well as to ensure compliance with the applicable NSF Customer Service Standard. The Standard specifies that NSF will make new funding opportunities available to the proposer community at least ninety (90) days prior to the full proposal deadline or target date."

Note that there are 20 funding opportunities with no fixed deadline date where proposals may be submitted at any time. These opportunities are counted in the overall number of opportunities for each fiscal year; however, they are not included in the fiscal year averages. The data are based on full proposal deadlines only. Some funding opportunities indicate a high number of days between the publication date and deadline date. In most cases this was due to a program with a required preliminary proposal (which are not included in the average).

FY 2014: 116 days
FY 2015: 125 days
FY 2016: 124 days

Question 2. For each of the last three years, please provide a list of every Request for Proposal issued, along with the solicitation date and the due date.

Answer: Attachment 1 contains the list of funding opportunities issued in the last three fiscal years. This includes the clearance/published date as well as associated deadline dates. A number of standing program descriptions have been in place for more than three years and are updated annually to address minor changes (these are identified as "Overwritten" in the spreadsheet). In addition, there are 20 funding opportunities with no fixed deadline date where proposals may be submitted at any time (these are identified as "Anytime" in the spreadsheet).

Question 3. In your opinion, what would be the impact the NSF might anticipate if it was to require a minimum response time of 90 days from the issuing of the solicitation, with a possible waiver authority residing with the NSF Director for cases where a more rapid response would be needed and justified to be in the nation's best interest?

Answer: There would be no impact since NSF currently requires all funding opportunities to be released with a minimum of 90 days prior to a deadline date. Our internal guidance on clearance in the Proposal and Award Manual (PAM) states:

Public notice must be given for new funding opportunities to allow adequate time for NSF competition and proposal preparation, as well as to ensure compliance with the applicable NSF Customer Service Standard. The Standard specifies that NSF will make new funding opportunities available to the proposer community at least ninety (90) days prior to the full proposal deadline or target date.

Regarding the second part of this question, on the need for a more rapid response, NSF currently uses the RAPID mechanism to be able to receive and fund proposals to accomplish just such a goal. As stated in the Proposal and Award Policies and Procedures Guide (PAPPG) – Chapter II.E.1:

The Rapid Response Research (RAPID) mechanism is a type of proposal used when there is a severe urgency with regard to availability of, or access to, data, facilities or specialized equipment, including quick-response research on natural or anthropogenic disasters and similar unanticipated events.

GEOGRAPHIC DISTRIBUTION OF NSF GRANT AWARDS

As you know, the geographic distribution of awards is not uniform across the country – this is one motivation for the EPSCoR program. However, it seems that EPSCoR alone is insufficient to improve the geographic distribution of NSF science and technology (S&T) investments. The U.S. is competing in a global knowledge economy that grows increasing more competitive every day; therefore, if geographic regions within the U.S. want to compete well in this knowledge-based economy, they need to have sufficient capabilities in S&T. Those regions that are lagging will also lag in quality of life, and the task of closing the gap only gets harder. This is not about a scientific welfare program. This is about how to improve the S&T competitiveness of our nation. This is the NATIONAL Science Foundation, not the East Coast Science Foundation or the West Coast Science Foundation.

Question 4. For each of the last five years, please provide the number of grant awards and the total dollars awarded for each of the 50 states, the District of Columbia, and the U.S. territories.

Answer: The table below provides the number of grant awards and total dollars obligated for fiscal years 2012 through 2016. Data are shown for the 50 states, District of Columbia, and the U.S. territories. Award counts include both new awards as well as funding on awards made in prior years.

	NSF Obligations and Award Counts (Dollars in Millions)									
	FY 2012		FY 2013		FY 2014		FY 2015		FY 2016	
	Oblg	Count	Oblg	Count	Oblg	Count	Oblg	Count	Oblg	Count
Alabama	$47.37	212	$45.99	184	$45.31	186	$34.28	157	$46.04	177
Alaska	$34.93	111	$34.41	113	$39.19	106	$35.61	98	$35.70	108
Arizona	$156.72	496	$159.71	455	$182.52	430	$239.47	432	$255.96	443
Arkansas	$19.24	75	$19.44	66	$19.05	61	$16.21	56	$24.65	59
California	$920.06	2,721	$960.44	2,520	$972.11	2,509	$940.82	2,558	$963.22	2,557
Colorado	$364.73	617	$360.56	555	$379.20	570	$339.26	552	$320.01	610
Connecticut	$60.56	293	$59.19	288	$71.44	274	$68.32	278	$79.65	282

	NSF Obligations and Award Counts (Dollars in Millions)									
	FY 2012		FY 2013		FY 2014		FY 2015		FY 2016	
	Oblg	Count	Oblg	Count	Oblg	Count	Oblg	Count	Oblg	Count
Delaware	$33.54	143	$36.69	124	$39.21	126	$25.59	110	$46.12	129
District of Columbia	$395.27	359	$348.93	313	$359.47	328	$278.16	334	$255.30	348
Federated Micronesia	$0.01	1	$0.00	0	$0.00	0	$0.00	0	$0.00	0
Florida	$154.96	599	$156.10	546	$154.82	544	$187.83	586	$187.82	587
Georgia	$122.24	529	$136.15	502	$128.08	509	$149.63	543	$138.68	553
Guam	$0.38	3	$0.20	1	$0.13	1	$2.05	3	$2.11	2
Hawaii	$46.03	128	$45.66	109	$41.29	109	$41.64	104	$43.05	119
Idaho	$18.71	74	$27.89	66	$13.45	54	$26.16	65	$22.98	78
Illinois	$376.01	957	$317.87	878	$327.21	843	$312.29	885	$315.52	848
Indiana	$135.41	507	$144.06	453	$145.01	475	$144.35	500	$155.54	487
Iowa	$51.17	220	$54.76	211	$56.01	196	$59.34	197	$59.55	204
Kansas	$49.48	165	$30.83	112	$27.72	117	$38.97	141	$34.56	126
Kentucky	$25.30	115	$21.97	104	$26.40	115	$31.77	114	$31.21	137
Louisiana	$40.21	179	$38.00	167	$38.89	147	$30.61	166	$45.60	166
Maine	$28.57	86	$34.95	86	$21.18	81	$26.16	76	$17.10	71
Maryland	$250.71	547	$304.93	514	$336.25	537	$329.58	543	$343.28	537
Massachusetts	$457.27	1,413	$452.72	1,327	$461.10	1,278	$456.77	1,344	$448.70	1,285
Michigan	$179.53	732	$202.11	673	$210.97	699	$216.96	747	$212.89	680
Minnesota	$102.10	368	$97.63	333	$95.67	340	$113.93	319	$87.86	308
Mississippi	$25.45	89	$19.45	64	$16.30	62	$22.97	65	$32.33	76
Missouri	$50.34	253	$51.03	243	$53.68	232	$68.21	239	$68.79	253
Montana	$21.61	89	$29.19	88	$25.40	74	$21.63	87	$33.83	86
Nebraska	$21.72	86	$27.88	95	$35.81	99	$33.39	106	$31.72	96
Nevada	$12.65	64	$15.33	62	$22.46	87	$17.72	79	$15.61	86
New Hampshire	$35.01	134	$38.06	131	$37.50	125	$35.83	124	$42.25	125
New Jersey	$131.27	501	$126.87	490	$142.83	484	$147.25	505	$163.70	515
New Mexico	$42.19	139	$42.44	148	$43.10	127	$56.47	143	$51.84	172
New York	$458.87	1,619	$436.09	1,520	$467.95	1,545	$493.17	1,565	$480.11	1,529
North Carolina	$186.94	669	$167.13	623	$176.96	614	$189.97	624	$203.03	638
North Dakota	$10.46	48	$12.51	39	$17.25	49	$14.22	33	$21.06	47
Ohio	$130.95	578	$118.25	551	$113.44	491	$135.17	535	$238.93	543
Oklahoma	$29.43	127	$27.14	113	$33.14	125	$46.00	117	$29.79	116
Oregon	$72.32	314	$63.11	267	$89.44	286	$88.03	320	$90.68	335
Pennsylvania	$261.13	1,137	$275.73	1,053	$275.82	1,072	$292.04	1,066	$275.03	1,033
Puerto Rico	$8.34	28	$5.23	16	$18.20	33	$8.37	26	$15.48	34
Rhode Island	$42.08	211	$47.61	202	$45.55	215	$50.04	194	$41.89	189
South Carolina	$64.55	209	$45.30	205	$53.81	190	$58.60	201	$60.16	167
South Dakota	$14.69	46	$11.10	46	$22.40	53	$18.70	53	$11.63	46
Tennessee	$70.61	259	$63.92	238	$66.62	234	$67.40	239	$80.78	269
Texas	$260.85	1,180	$234.09	1,073	$233.29	1,022	$328.51	1,163	$344.25	1,111
Utah	$60.69	229	$67.96	235	$57.77	255	$68.84	260	$63.64	246
Vermont	$7.88	41	$11.59	41	$13.54	43	$11.87	33	$9.70	34
Virgin Islands	$2.67	4	$1.35	2	$4.97	4	$4.57	2	$6.67	4
Virginia	$285.53	621	$200.81	571	$204.02	537	$222.59	555	$212.63	552
Washington	$161.17	546	$139.91	459	$143.36	452	$149.97	489	$140.63	464
West Virginia	$18.36	44	$14.11	49	$15.12	47	$14.96	54	$14.92	46
Wisconsin	$127.04	452	$124.88	393	$108.77	380	$115.75	338	$113.08	352
Wyoming	$14.43	52	$18.34	40	$14.44	36	$13.81	37	$15.88	37

SPACE WEATHER

The nation (and the whole Earth) is not well-prepared for major geomagnetic storms that can cause major problems for satellites, power grids, etc. There has been some favorable bipartisan action recently in Congress with regard to space weather legislation that essentially laid out the responsibilities among the federal agencies for dealing with these storms. There was even a relatively noncontroversial Executive Order at the end of the Obama administration that dealt with the issue. The problem is that the legislation and the E.O. have not laid out an action plan or funding to address the issue.

Question 5. What is the potential for the U.S. scientific community to better understand the cause of geomagnetic storms from the sun? To better understand their propagation from the Sun towards the Earth? To better understand their impact on the Earth? To better predict the occurrence and magnitude of these storms? To recommend ways to make infrastructure in space and on Earth more resilient to these storms?

Answer: The challenges we face and approaches toward becoming a space-weather ready nation are expressed in a 2015 interagency space weather action plan[9]. Space weather encompasses the entire domain between the Sun and Earth, from solar eruptions, to solar-wind/magnetosphere/ionosphere interactions, to complex coupling between the ionosphere and the terrestrial lower atmosphere. US researchers have the potential to conduct the space weather research needed to meet the challenges articulated in the plan. The relevant federal agencies have laid out a detailed action plan to promote substantial progress toward making the U.S. a space weather ready nation. This plan involves NSF, primarily through GEO/AGS and MPS/AST, DOC, DHS, NASA, DOD, NASA, USGS, and DOE.

There exist significant gaps in our physical understanding of the coupled Sun-Earth system, and observational data coverage is sparse, especially in interplanetary space. Understanding the physical drivers of space weather events at the Sun and forecasting the associated geomagnetic storms at the Earth first requires understanding of solar eruptive events such as solar flares and coronal mass ejections. NSF's Daniel K. Inouye Solar Telescope (DKIST) is a prime example of a new observational capability which will provide new insights into the fundamental processes behind these events. Complementary to DKIST, infrastructure for the observation of coronal solar magnetism could prove critical to enabling understanding of the origin of the solar radiative and particle output and prediction of their evolution, to further support and enable forecasting of solar storms with an actionable lead time. New understanding and discovery will enable the further development of models of the Sun-Earth system, eventually giving us the ability to predict future events as we currently do for terrestrial weather.

A major source of error in space weather prediction arises from the lack of monitoring of solar disturbances as they travel from the Sun and impact the Earth. Better capabilities for tracking these disturbances will lead to significant improvements in forecasting event arrival times and conditions, which determine the strength of impacts at Earth. Advancing our fundamental understanding and improving our ability to predict the occurrence and intensity of these storms will require new observational capabilities and capacities. The US-wide networks of GNSS receivers provide critical ionospheric data needed to assess impacts on communication, navigation, and surveillance assets in the national defense and civilian sectors.

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[9] www.hsdl.org/?view&did=789864

The 2015 interagency space weather action plan identifies needs and approaches to make our nation more resilient against space weather events. However, implementation and space weather readiness demands reliable forecasts, and improved understanding of interactions within the coupled Sun-Earth system. An effective research to operations cycle (R2O2R) will require collaboration between science and end-user communities. In addition to supporting fundamental research and the tools needed to advance our understanding of, and ability to predict space weather, NSF is sponsoring meetings such as the Applied Space Environments Conference and Spacecraft Charging Technology Conference.

REGULATORY BURDEN ON UNIVERSITIES

Question 6. Does the NSF currently have any plans to reduce the federal regulatory and oversight burdens associated with receiving NSF grants, and if so, what are they?

Answer: NSF has always been mindful of the administrative burden placed on the research community and has consistently looked for ways to minimize and reduce the burden with respect to the preparation of proposals and management of NSF awards. NSF deliberately adopts approaches to implementing new administrative requirements in a manner that results in the lowest possible burden. Nonetheless, administrative requirements have accreted over time to such a degree that even low burden requirements may have a significant impact on the conduct and oversight of NSF funded research. Therefore, NSF, working in collaboration with the National Science Board (NSB) and other federal research agencies, is working to reduce administrative burden to the extent possible, while acknowledging the need for financial accountability and transparency as well as for safety and scientific integrity.

NSF has consistently advocated at the federal level for streamlined processes and requirements and has remained at the forefront of this issue for years. However, NSF believes additional improvements can be made to reduce the administrative workload further—not only for the research and education communities, but also for NSF staff. NSF has adopted the following framework that was articulated in the NSB report, *Reducing Investigators' Administrative Workload for Federally Funded Research*: (1) Focus on the Science; (2) Eliminate or Modify Ineffective Regulations; (3) Harmonize and Streamline Requirements; and (4) Increase University Efficiency and Effectiveness. NSF is involved in each of these areas in either proposing solutions or coordinating with other agencies in seeking desired common outcomes.

NSF utilizes a transparent process for the community to understand and comment on proposed changes to policies and procedures that affect their researchers and organization. Each year, NSF publishes a draft version of the *Proposal & Award Policies & Procedures Guide* (PAPPG) in the Federal Register for community comment. Upon resolving all submitted questions, comments, and suggestions, NSF reissues the PAPPG in a final format. Prior to its implementation, NSF allows the community a minimum of 90 days to review and understand all of the revisions and clarifications. This permits a full, transparent process and helps to reduce administrative burden in the research community.

Finally, NSF is currently co-Chair of the National Science and Technology Council's (NSTC) Research Business Models (RBM) Interagency Working Group which has a goal of improving the efficiency, effectiveness, and accountability of the federal research and development enterprise. The RBM has responsibility for two major initiatives designed to reduce administrative burden by harmonizing policies for awards from federal research agencies, and NSF has a primary role in both initiatives. First, NSF co-Chairs the Research Performance Progress Report (RPPR) Subcommittee. The Subcommittee developed a consistent dataset for use by federal research agencies for the submission of progress reports from recipient organizations. Second, NSF also co-Chairs the Research Terms and Conditions (RTC) Subcommittee which has a stated priority of creating greater consistency in the administration of federal research awards by applying a set of terms and conditions that apply to research and research-related grants to institutions of higher education and non-profit organizations.

NSF SUPPORT FOR NASA

There is some uncertainty about whether or not proposals that include fundamental research that could eventually be applied to aerospace systems are discouraged at the NSF.

Question 7. Does the NSF has any concerns about funding basic research proposals that specifically states that, and describes how, the results of their research plan could be applied to NASA interests? • For example, would the NSF fund innovative materials science research that would specifically be applied to substantive improvements for aerospace structures? • Would the NSF fund innovative chemical engineering research that led to substantively improved rocket fuels?

Answer: NSF does not discriminate against funding fundamental science that may help solve problems at mission agencies, including NASA. For example, NSF's Metals and Metallic Nanostructures program currently funds fundamental research in structural materials and most recently NSF and NASA discussed possible co-funding innovative materials science proposals in connection with the NSF Materials Innovation Platforms (MIPs)[10] program.

Additionally, NSF has funded collaborative research through the Designing Materials to Revolutionize and Engineer our Future (DMREF)[11] program that has developed new structural materials for the airline industry.

NSF would fund innovative chemical engineering research, including fundamental research to substantively improve rocket fuels. NSF currently collaborates with NASA to fund the Center for Chemical Evolution (CCE).

EPSCoR

Question 8. What would be the impact of your proposed cuts to the EPSCoR program to Alabama?

Answer: If the proposed cuts were to take effect, existing awards could continue to be funded, contingent upon satisfactory project progress.

Question 9. Why was the proposed cut to EPSCoR so much larger than other cuts in the NSF budget?

Answer: NSF had to make a number of tough choices in this budget, and this was one of them. In terms of actual obligations, EPSCoR funding grew by $57.92 million between 2007 and 2017,

[10] www.nsf.gov/funding/pgm_summ.jsp?pims_id=505133
[11] www.nsf.gov/funding/pgm_summ.jsp?pims_id=505073

an increase of 56.7 percent. This increase was much larger than NSF's 27.4 percent increase over the same period.. EPSCoR remains important to the Foundation.

Question 10. What is NSF doing to ensure greater participation of EPSCoR states in regular (non-EPSCoR) programs?

Answer: The NSF EPSCoR program continues to promote engagement of the EPSCoR community in NSF and other national activities. Examples include (but are not limited to):

- EPSCoR maintains its efforts to better communicate the "EPSCoR success story" by continuing its communication workshop, "Becoming an EPSCoR Champion," which targets Research Infrastructure Improvement (RII) Track-1 researchers to specifically emphasize successful outcomes of their research. This workshop series helps researchers cultivate communication skills through disciplined, systematic messaging to convey an influential, economically-framed message that effectively signals the value of EPSCoR's activities. It seeks to enhance abilities to deliver the jurisdiction's scientific messages effectively, charismatically, and successfully.
- EPSCoR has continued to encourage the involvement of EPSCoR-supported faculty in NSF committees and review panels across NSF (e.g., Committees of Visitors (COVs), site visits, and merit review panels).
- EPSCoR invested in RII Track-2: Focused EPSCoR Collaborations (RII Track-2 FEC) solicitation. RII Track-2 FEC builds interjurisdictional collaborative teams of EPSCoR investigators in scientific focus areas consistent with NSF priorities, including cognitive science and neuroscience, genome to phenome, clean energy, and food security. In addition, these awards have a particular focus on the development of early career/junior faculty.
- The Extreme Science and Engineering Discovery Environment (XSEDE) is a five-year, $121 million project supported by NSF that serves as a single virtual system of digital resources and services for scientists and educators. NSF EPSCoR has partnered with XSEDE to broaden participation and usage by EPSCoR investigators in order to accelerate scientific discovery, share data and expertise, and educate future generations on computational tools, resources, and methods. Thirty EPSCoR jurisdictions currently use the computing resources, data, and expertise provided by XSEDE. There are currently 276 allocations to 243 unique principal investigators in EPSCoR jurisdictions.
- In its effort to embrace new technology and support EPSCoR participants who would otherwise not have access to outreach, EPSCoR hosts topical webinars on jurisdiction-requested topics. Some examples include: the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative, the Graduate Research Fellowship Program (GRFP), the Industry-University Cooperative Research Centers (IUCRC) program, the Science and Technology Centers (STC), and the Small Business Innovation Research (SBIR) program.
- As part of its Outreach investment strategy, EPSCoR supports travel of NSF staff to EPSCoR jurisdictions to share information on NSF programs, strategic priorities, and funding opportunities. A total of 348 NSF staff attended 217 EPSCoR jurisdictional events over the past five years. These include NSF Days and Regional Grants Conferences; EPSCoR jurisdictions Alaska, Delaware, Maine, and Wyoming hosted NSF Days in FY 2016-FY 2017. Kentucky hosted a Regional Grants Conference in FY 2017. EPSCoR also capitalizes on its outreach efforts by hosting informational webinars on NSF-supported programs. Additionally, there is an effort to promote in-reach, whereby EPSCoR facilitates opportunities for researchers and educators from EPSCoR jurisdictions to meet with NSF staff at the Foundation's headquarters. In FY 2016, EPSCoR staff facilitated approximately 35 in-reach meetings.
- Through co-funding, EPSCoR co-invests with NSF directorates and offices to support meritorious proposals submitted by investigators in EPSCoR jurisdictions to the

Foundation's research and education programs and crosscutting initiatives. These proposals have been merit reviewed by the directorates and offices, recommended for awards, but cannot be funded without the support of EPSCoR. Co-funding leverages EPSCoR investment and facilitates participation of EPSCoR scientists and engineers in Foundation-wide programs and initiatives. In FY 2016 EPSCoR co-funded 160 new projects, totaling $68.10 million ($27.90 million of which was from EPSCoR).

Question 11. How many NSF advisory committees contain representatives from EPSCoR states? Please name advisory committees, number of representatives from EPSCoR states and percentage.

Answer: Of NSF's 13 active advisory committees, 11 have representatives from EPSCoR states. The names of the committees, the number of representatives from EPSCoR states, and the percentage of the overall committee membership are given in the table below. Among the combined membership of all 13 advisory committees, 11.2 percent (23 members) are from EPSCoR states.

Advisory Committee	# from EPSCoR	% from EPSCoR
Biological Sciences	4	26.7%
Computer & Information Science & Engineering	1	4.5%
Education and Human Resources	2	8.7%
Engineering	1	7.7%
Geosciences	2	10.5%
Mathematics and Physical Sciences	1	8.3%
International Science and Engineering	0	0.0%
Social, Behavioral, and Economic Sciences	0	0.0%
Business and Operations	1	5.3%
Committee on Equal Opportunities in Science and Engineering	4	25.0%
Cyberinfrastructure	4	28.6%
Environmental Research and Education	2	12.5%
Astronomy and Astrophysics	1	7.7%
Total	**23**	**11.2%**

Questions for the Record Submitted by Evan Jenkins

GREEN BANK OBSERVATORY

Question 1. What is the total funding level required to operate the Green Bank Observatory at current levels? Please provide a cost breakdown in the following categories: Green Telescope; telescope operations; Quiet Zone management; plant and facility maintenance; site management; other site telescopes; education center; visitor services; development program; and NRAO central administration.

Answer: NSF cannot provide information at this level of detail because it is proprietary to the managing organization.

Question 2. The FY 2018 budget request recommends a level of $11.85 million for the operations of the Green Bank Observatory and the VLBA. Of this amount, please provide the level of funding will be dedicated to the operations of the Green Bank Observatory.

Answer: Of the $11.85 million requested for Other Astronomical Facilities, NSF expects that roughly $8.4 million will support GBO. The balance of GBO income originates from sources other than the NSF Division of Astronomical Sciences (AST), such as Breakthrough Listen ($2.0 million), NANOGrav Project, West Virginia University, and work for others. AST's portion together with those sources of income balance GBO's budget.

EPSCoR

Question 1. Most recently West Virginia was awarded $20 million through the EPSCoR program. With the proposed cuts to the EPSCoR program, what will be the impact in the grants awarded to the various states, or grants that were multi-year awards if the proposed cuts were to take effect?

Answer: If the proposed cuts were to take effect, existing awards could continue to be funded, contingent upon satisfactory project progress.

Question 2. What work is NSF doing to boost EPSCoR states' awards and participation in non-EPSCoR grant programs and other programs?

Answer: The NSF EPSCoR program continues to promote engagement of the EPSCoR community in NSF and other national activities. Examples include (but are not limited to):

- EPSCoR maintains its efforts to better communicate the "EPSCoR success story" by continuing its communication workshop, "Becoming an EPSCoR Champion," which targets Research Infrastructure Improvement (RII) Track-1 researchers to specifically emphasize successful outcomes of their research. This workshop series helps researchers cultivate communication skills through disciplined, systematic messaging to convey an influential, economically-framed message that effectively signals the value of EPSCoR's activities. It seeks to enhance abilities to deliver the jurisdiction's scientific messages effectively, charismatically, and successfully.
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investigators in scientific focus areas consistent with NSF priorities, including cognitive science and neuroscience, genome to phenome, clean energy, and food security. In addition, these awards have a particular focus on the development of early career/junior faculty.

- The Extreme Science and Engineering Discovery Environment (XSEDE), is a five-year, $121-million project supported by NSF that serves as a single virtual system of digital resources and services for scientists and educators. NSF EPSCoR has partnered with XSEDE to broaden participation and usage by EPSCoR investigators to accelerate scientific discovery, share data and expertise, and educate future generations on computational tools, resources, and methods. Thirty EPSCoR jurisdictions currently use the computing resources, data and expertise provided by XSEDE. There are currently 276 allocations to 243 unique principal investigators in EPSCoR jurisdictions.
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Question 3. The FY 2018 budget request proposes to reduce the EPSCoR program from $160 million to $100 million. Please explain specifically how this will impact the Research Infrastructure Improvement (RII) programs (Tracks-1, 2, 3, and 4) and co-funding and how this will help build research capacity in the eligible states?

Answer: At the $100.0 million FY 2018 Budget Request level, EPSCoR can fund existing RII Track-1 projects, contingent on satisfactory project progress. EPSCoR will have a merit review competition for RII Track-1 proposals submitted to the FY 2018 competition. No other tracks are planned for FY 2018 and nominal co-funding is possible.

Question 4. In relation to the EPSCoR program, for each of the past five years, please provide the following, amount allocated to Track 1; amount allocated to all other tracks; amount allocated to co-funding.

Answer: EPSCoR does not allocate funds to specific tracks and the actual amount awarded by track depends on the outcomes of merit review competitions. In prior fiscal years, EPSCoR was able to fund all meritorious RII Track-1 proposals. Any other available funds are used for the other tracks and co-funding.

NSF EPSCoR Budget by Activity
(Dollars in Millions)

	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
RII	$110.60	$116.34	$131.90	$137.44	$131.00
Outreach	1.43	0.47	0.97	0.47	1.13
Co-Funding	38.83	30.79	25.32	27.55	27.90
Total	**$150.86**	**$147.60**	**$158.19**	**$165.46**	**$160.03**

NSF EPSCoR RII Budget by Track[1]
(Dollars in Millions)

	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
Track 1	$110.60	$88.60	$110.16	$116.54	$77.30
Track 2	-	24.00	18.00	20.90	53.70
Track 3	-	3.70	3.74	-	-
Total	**$110.60**	**$116.30**	**$131.90**	**$137.44**	**$131.00**

[1] EPSCoR RII Track 4 not show n because it w as initiated in FY 2017.

Question 5. In the current environment, the nation needs all the scientific expertise we can develop. Every state needs the benefits of research institutions. Does NSF believe that focusing 88% of its funding in only half the states, leaving the others with very limited support, is sound policy?

Answer: NSF works diligently to develop the research capacity of every EPSCoR jurisdiction. NSF operates through merit review, therefore, funding flows to meritorious projects wherever they may be located. NSF does not operate on any pre-determined allocations by state. In general, more populous states with more research organizations submit more proposals than sparsely populated states and, consequently, receive more awards. The success rates of proposals from EPSCoR jurisdictions is relatively close to that for proposals from non-EPSCoR jurisdictions.

Questions for the Record Submitted by Derek Kilmer

OFFICE OF INTEGRATIVE ACTIVITIES

Question 1. The American Innovation and Competitiveness Act includes the "role of the human factor in cybersecurity" as a possible research area to supplement the cybersecurity research already being supported at NSF. Similarly, in a letter to the House Science, Space, and Technology Committee, the Computing Research Association described people as "often the weakest link in the chain" of a cybersecurity network. Yet it seems that the human-side of cybersecurity is still considered an afterthought. The President's Budget Request calls for a 26 percent cut to the Office of Integrative Activities; this office works across disciplinary boundaries to lead and coordinate strategic programs and opportunities. Would the proposed cuts to this office impact research into the interplay of social science and cybersecurity?

Answer: The major reductions in the Integrative Activities budget line are to the EPSCoR and Graduate Research Fellowship (GRF) programs. These proposed budget cuts would not impact research on the interplay of social science and cybersecurity. NSF will continue its research investments on the interplay of social science and cybersecurity as well as cybersecurity research more generally through the Secure and Trustworthy Cyberspace (SaTC) priority area that is led by CISE in partnership with EHR, ENG, MPS, and SBE.

Question Can you elaborate on how social science research can support cybersecurity efforts and how NSF is investing in this research?

Answer: There is increasing appreciation that many scientific and practical challenges of security, privacy, and trust are rooted not just in technical aspects, but in sociotechnical dimensions. For example, there are economic factors and incentives that motivate hackers and others who produce malware, as well as those who design secure software. There are also behavioral drivers that underlie what passwords we set for ourselves, and how secure we make the smartphones and tablets that we use on a daily basis. Researchers supported by NSF have provided important insights into the online behavior, social dynamics, and financial activities of information technology (IT) users and hackers in order to design and implement IT systems that are both more secure and easier to use. Research at the intersection of the social and computer sciences will also help us understand how individuals, groups and organizations make decisions relevant to cybersecurity. We can investigate the motivations and incentives of individuals and institutions—both as attackers and defenders of cyberspace—to develop a more cyber-secure society. Therefore, it is critical to encourage interdisciplinary collaborations among researchers from the disciplines supported by NSF's CISE and SBE directorates.

Over the last several years, NSF's Secure and Trustworthy Cyberspace (SaTC) program has supported research projects that span computer science, the social, behavioral and economic sciences, as well as mathematics, engineering, and education. The program seeks to enable work that brings together these varied disciplinary perspectives to help us understand, predict, and explain prevention, attack, and defense behaviors. It also contributes to developing strategies for remediation. And it ensures that we are able to preserve individual privacy and promote usability. Topics include:

- Theoretical and practical methods to design, build, analyze and operate cyber systems that are secure, private, and usable;
- Tradeoffs across security and usability or accountability and privacy; and

- The design of incentives or markets to reduce either the likelihood of cyber-attacks or the negative consequences of cyber-attacks, or that examine incentives and motivations of individuals.

Ultimately NSF's investments in SaTC recognize that cybersecurity is a multi-dimensional problem that involves both the strength of security technologies and the variability of human behavior. The SaTC portfolio includes projects studying security in human-centric systems and in a variety of web-application contexts as well as in smartphones, voting systems, medical devices, automotive systems, and other cyber-physical systems.

SOCIAL AND BEHAVIORAL SCIENCES

Question 2. Social and Behavioral Sciences, is slated for a cut of more than 10 percent in the proposed budget. Yet understanding how people, generally, act and communicate is something that makes us more successful. For example, four years ago, the University of Washington was awarded a grant to research a Magnitude 9 earthquake, which would cause a tsunami along the peninsula in my district. Don't we want a better understanding of people's behaviors to help address and prevent problems? Another example, the Golden Goose Award, which was the brainchild of our colleague Jim Cooper, recognizes federally supported science which at the time seemed irrelevant but has led to groundbreaking developments. We're literally spending trillions every year to address costs of healthcare. Don't we think that social science research can help with things like health behaviors in the long run?

Answer: The Social, Behavioral and Economic (SBE) sciences provide tremendous benefits to the scientific enterprise, to society, and to the lives of Americans. As noted in a recent report from the National Academies of Sciences titled *The Value of Social, Behavioral, and Economic Sciences to National Priorities: A Report for the National Science Foundation*, "Nearly every major challenge the United States faces—from alleviating unemployment to protecting itself from terrorism—requires understanding the causes and consequences of people's behavior."[12]

Every day, people shape and are shaped by the economic, political, social, cultural, technological, and environmental forces that surround us. The SBE sciences collectively examine the confluence of these forces on people and illuminate the fundamental principles underlying human behavior—from how we think and learn to how we interact individually and in groups. They help to better navigate relationships, build stronger and safer communities, run businesses efficiently and effectively, and create technologies that enrich our lives.

Several examples are below:

Better warning systems, better disaster response

When a severe storm approaches, how a person responds can be a matter of life and death. Human response in the face of disaster greatly depends on how weather experts communicate the risks. Scientists at the University Corporation for Atmospheric Research worked with the National Oceanic and Atmospheric Administration (NOAA) and their National Weather Service emergency responders to improve the communication of weather-related risks to the public.

[12] National Academies of Sciences, Engineering, and Medicine. 2017. The Value of Social, Behavioral, and Economic Sciences to National Priorities: A Report for the National Science Foundation. Washington, DC: The National Academies Press. Retrieved from: www.nap.edu/catalog/24790/the-value-of-social-behavioral-and-economic-sciences-to-national-priorities

Storm forecasting has improved greatly in the past decades. The forecasts for the strength and path of both Hurricane Katrina and Sandy were largely accurate. Yet Katrina and Sandy were the two most deadly storms in recent U.S. history. One reason for this may be the disconnect that exists between what meteorologists know about the forecasts and the risks that are understood by both meteorologists and the public.

This disconnect is pronounced when it comes to the effects of storm waters. Rain, direct exposure to the surf, and rising waters due to the storm, known as storm surge, cause over 80% of the deaths related to tropical cyclones[13]. Despite this, the traditional way to describe and rank the severity of hurricanes is based on wind-speed, the Saffir-Simpson Hurricane Wind Scale[14]. Researchers surveyed meteorologists and members of the public in high-risk areas to assess what they did and did not understand about storm surge risks. They then used this information to build and test new visual displays of storm surge risk. The results of the team's research are reflected in the new graphical warning system that NOAA launched in 2014. The Potential Storm Surge Flooding Map[15], with its bright, clean, eye-catching graphics and plain English descriptions of weather conditions, is a world away from the previous communication techniques.

Life Saving Kidney Exchanges

Using a theory of human decision-making that was developed in the context of matching men and women in a hypothetical marriage market, economist Alvin Roth and his colleagues—with support from SBE—developed algorithms that have been used for paired kidney transplant exchanges that allow chains of people to donate and receive compatible kidneys. To put this in the context of health care costs, Medicare spending per person per year on dialysis was about $88,000 in 2014, the latest year for which there is data, whereas Medicare spent less than $33,000 on a transplant—about a third of what is spent on dialysis for one year alone. To date (through March 2017, there have been 4,818 people in the U.S. who have received a life-saving and money saving kidney through paired donations. And transplants provide a much better quality of life and longer life as compared to dialysis.

Al Roth was awarded the Nobel Prize in Economics for his work. Roth's other research on matching and markets has been applied to match kids with public schools in New York, Boston, and many other cities and to match new doctors graduating from medical schools with appropriate hospitals around the country for their medical residencies.

Limiting the spread of infectious disease

The recent 2013-2016 outbreak of Ebola in West Africa, coupled with seasonal influenza, demonstrate the necessity of managing the threat of pandemics. New technologies now allow researchers to better understand the nature of social structure as it impacts the spread of infectious disease. Anthropologist James Holland Jones and colleagues of Stanford University investigated methods to prevent the spread of flu-like infectious disease in school settings. Every student, teacher and staff member of one high school was outfitted with a credit card-sized wireless sensor to monitor contact for one whole school day and model social networks. The resulting models simulated how influenza infection would spread through the community based on real-world contact. The models also allowed researchers to explore strategies for efficient disease management such as vaccinations and school closings. Most vaccination strategies were no more effective than random vaccinations in preventing the spread of disease. However, social distancing strategies in which schools were intermittently closed (e.g., two days open, two days

[13] http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-12-00074.1
[14] www.nhc.noaa.gov/aboutsshws.php
[15] www.nhc.noaa.gov/cyclones/

closed) interrupted the contact network, and were nearly as effective as a complete three-week school shutdown. These findings provide useful insight for school administrators and public health officials into the development of effective prevention strategies.

NSF FY 2014 Solicitation Publication Data

Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
NSF 14-519	105804	Expeditions in Computing	10/6/13	12/10/14	431	14
NSF 14-500	105747	National Robotics Initiative	10/18/13	1/21/14	96	14
NSF 14-501	105768	Petrology and Geochemistry	10/21/13	1/21/14	93	14
NSF 14-514	105828	Cognitive Neuroscience	10/22/13	2/25/14	127	14
NSF 14-502	105792	Coastal SEES	10/23/13	1/21/14	91	14
NSF 14-503	105751	Division of Environmental Biology (core programs)	10/28/13	8/4/14	281	14
NSF 14-504	105560	Collaborative Research in Computational Neuroscience	10/28/13	1/27/14	92	14
NSF 14-505	105601	Alliances for Graduate Education and the Professoriate	10/29/13	2/5/14	100	14
NSF 14-506	105729	Faculty Development in the Space Sciences	10/29/13	1/27/14	91	14
NSF 14-508	105796	Robert Noyce Teacher Scholarship Program	11/7/13	3/5/14	119	14
NSF 14-509	105764	Atmospheric and Geospace Sciences Postdoctoral Research Fellowships	11/8/13	2/10/14	95	14
NSF 14-512	105781	Innovative Technology Experiences for Students and Teachers	11/13/13	2/11/14	91	14
NSF 14-516	105801	Exploiting Parallelism and Scalability	11/26/13	2/24/14	91	14
NSF 14-517	105814	Building Community and Capacity for Data-Intensive Research in the Social, Behavioral, and Economic Sciences and in Education and Human Resources	12/3/13	3/3/14	91	14
NSF 14-518	105811	Petascale Computing Resource Allocations	12/5/13	3/10/14	96	14
NSF 14-520	105763	Software Infrastructure for Sustained Innovation - SSE & SSI	12/16/13	3/17/14	92	14
NSF 14-524	105789	Resilient Interdependent Infrastructure Processes and Systems	12/20/13	3/19/14	90	14
NSF 14-525	105783	Dimensions of Biodiversity FY2014	12/20/13	4/3/14	105	14
NSF 14-526	105810	Cyberlearning and Future Learning Technologies	12/20/13	3/19/14	90	14
NSF 14-527	105757	Genealogy of Life	12/23/13	3/26/14	94	14
NSF 14-529	105854	Enhancing Access to the Radio Spectrum	1/3/14	4/18/14	106	14
NSF 14-530	105835	Data Infrastructure Building Blocks	1/8/14	4/9/14	92	14
NSF 14-532	105821	Faculty Early Career Development (CAREER) Program	1/10/14	7/21/14	193	14
NSF 14-533	105852	Plant Genome Research Program	1/28/14	4/28/14	91	14
NSF 14-534	105750	Sustainability Research Networks Competition	1/29/14	4/29/14	91	14
NSF 14-535	105868	CubeSat-based Science Missions for Geospace and Atmospheric Research	2/10/14	5/12/14	92	14
NSF 14-536	105834	High Performance Computing System Acquisition: Continuing the Building of a More Inclusive Computing Environment for Science and Engineering	2/14/14	5/14/14	90	14
NSF 14-537	105786	Geography and Spatial Sciences Program	2/19/14	9/4/14	198	14
NSF 14-538	105787	Geography and Spatial Sciences Program - Doctoral Dissertation Research Improvement Awards	2/19/14	8/14/14	177	14
NSF 14-539	105872	Small Business Innovation Research Program Phase I Solicitation	2/25/14	6/10/14	105	14
NSF 14-540	105888	Small Business Technology Transfer Program Phase I Solicitation	2/25/14	6/11/14	106	14

NSF FY 2014 Solicitation Publication Data

Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
NSF 14-541	105874	Nanotechnology Undergraduate Education (NUE) in Engineering	2/27/14	5/27/14	90	14
NSF 14-542	105832	Cyber-Physical Systems	3/5/14	6/2/14	90	14
NSF 14-544	105884	Scalable Nanomanufacturing	3/19/14	6/16/14	90	14
NSF 14-545	105894	Coupling, Energetics, and Dynamics of Atmospheric Regions	3/19/14	7/17/14	121	14
NSF 14-548	105861	National Science Foundation Research Traineeship (NRT) Program	3/27/14	6/24/14	90	14
NSF 14-550	105914	Geomorphology and Land Use Dynamics	4/2/14	7/16/14	106	14
NSF 14-551	105896	Linguistics Program - Doctoral Dissertation Research Improvement Awards	4/4/14	7/15/14	103	14
NSF 14-553	105912	EarthScope National Office	4/8/14	9/26/14	172	14
NSF 14-554	105840	International Research Network Connections	4/8/14	7/7/14	91	14
NSF 14-555	105909	Advancing Informal STEM Learning	4/9/14	7/10/14	93	14
NSF 14-557	105904	Decision Frameworks for Multi-Hazard Resilient and Sustainable Buildings	4/22/14	7/24/14	94	14
NSF 14-558	105850	EPSCoR Research Infrastructure Improvement Program Track-1	4/22/14	8/5/14	106	14
NSF 14-559	105910	Opportunities for Promoting Understanding through Synthesis	4/23/14	8/1/14	101	14
NSF 14-561	105944	Biological Anthropology Program - Doctoral Dissertation Research Improvement Grants	4/25/14	7/28/14	95	14
NSF 14-563	105902	Wireless Innovation between Finland and US	4/30/14	8/1/14	94	14
NSF 14-564	105966	Collections in Support of Biological Research	5/9/14	8/11/14	95	14
NSF 14-565	105879	Centers of Research Excellence in Science and Technology (CREST) and HBCU Research Infrastructure for Science and Engineering (RISE)	5/14/14	8/13/14	92	14
NSF 14-569	105963	Partnerships for Innovation: Accelerating Innovation Research- Technology Translation	5/23/14	10/2/14	133	14
NSF 14-570	105946	Theory Institute in Atomic, Molecular and Optical Physics	5/28/14	12/8/14	195	14
NSF 14-562	105727	Computer and Information Science and Engineering (CISE) Research Initiation Initiative	6/3/14	9/24/14	114	14
NSF 14-572	105886	Tribal Colleges and Universities Program	6/3/14	9/2/14	92	14
NSF 14-573	105883	ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers	6/3/14	9/22/14	111	14
NSF 14-568	105701	Management and Operation of the National Radio Astronomy Observatory	6/3/14	11/25/14	175	14
NSF 14-574	105898	Methodology, Measurement, and Statistics	6/4/14	9/2/14	90	14
NSF 14-575	105900	US-Japan Big Data and Disaster Research	6/9/14	9/8/14	92	14
NSF 14-576	105932	Division of Physics: Investigator-Initiated Research Projects	6/17/14	10/22/14	127	14
NSF 15-579	106199	Division of Physics: Investigator-Initiated Research Projects	6/17/14	10/28/15	498	15
NSF 14-577	105959	Advanced Technological Education	6/17/14	10/9/14	114	14
NSF 14-571	105919	NSF/Intel Partnership on Cyber-Physical Systems Security and Privacy	6/18/14	10/28/14	132	14
NSF 14-507	105736	Long Term Research in Environmental Biology	10/30/13	8/1/14	276	14
NSF 14-578	105994	Science of Science and Innovation Policy Doctoral Dissertation Research Improvement Grants	6/23/14	9/22/14	91	14

NSF FY 2014 Solicitation Publication Data

Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
PD 14-7569	106004	Sensors, Dynamics, and Control	6/24/14	9/15/14	82	14
NSF 14-579	103721	Facilitating Research at Primarily Undergraduate Institutions: Research in Undergraduate Institutions (RUI) and Research Opportunity Awards (ROA)	7/1/14	Anytime	Anytime	14
NSF 14-560	105931	Cultural Anthropology Program - Doctoral Dissertation Research Improvement Grants	4/24/14	8/15/14	114	14
NSF 14-580	105984	Documenting Endangered Languages	7/7/14	10/6/14	91	14
NSF 14-581	105958	Interdisciplinary Research in Hazards and Disasters	7/9/14	12/3/14	147	14
NSF 14-582	106012	Mathematical Sciences Postdoctoral Research Fellowships	7/10/14	10/15/14	98	14
NSF 14-583	105942	Centers for Chemical Innovation	7/10/14	10/21/14	103	14
NSF 14-584	105997	Arctic Research Opportunities	7/14/14	10/21/14	99	14
NSF 14-585	105971	Research Training Groups in the Mathematical Sciences	7/15/14	10/14/14	91	14
NSF 14-587	105903	Partnerships for International Research and Education	7/21/14	5/15/15	299	14
NSF 14-586	105996	CyberCorps(R): Scholarship for Service	7/21/14	10/21/14	93	14
NSF 14-588	105977	Improving Undergraduate STEM Education	7/22/14	10/22/14	92	14
NSF 14-589	105978	Enriched Doctoral Training in the Mathematical Sciences	7/29/14	11/12/14	106	14
NSF 14-590	105956	Graduate Research Fellowship Program	8/1/14	10/29/14	90	14
NSF 14-591	105950	Designing Materials to Revolutionize and Engineer our Future	8/1/14	1/29/15	181	14
NSF 14-592	105954	Ecology and Evolution of Infectious Diseases	8/1/14	11/19/14	110	14
NSF 14-593	106006	CISE Research Infrastructure	8/5/14	11/6/14	94	14
NSF 14-566	105955	Archaeology Program - Doctoral Dissertation Research Improvement Awards (Arch-DDRI)	8/5/14	Anytime	Anytime	14
NSF 14-594	105962	Management and Operation of the Gemini Observatory	8/7/14	2/27/15	205	14
NSF 14-595	105969	SBE Postdoctoral Research Fellowships	8/7/14	11/10/14	96	14
NSF 14-596	105975	Information and Intelligent Systems (IIS): Core Programs	8/12/14	11/10/14	90	14
NSF 14-597	105992	Computer and Network Systems (CNS): Core Programs	8/12/14	11/10/14	90	14
NSF 14-598	105982	Computing and Communication Foundations (CCF): Core Programs	8/12/14	11/10/14	90	14
NSF 14-599	105993	Secure and Trustworthy Cyberspace	8/12/14	11/10/14	90	14
NSF 14-600	105916	Science and Technology Centers: Integrative Partnerships	8/13/14	6/16/15	308	14
NSF 14-601	106007	Dynamics of Coupled Natural and Human Systems	8/13/14	11/18/14	97	14
NSF 14-602	106015	IUSE / Professional Formation of Engineers: Revolutionizing Engineering Departments	8/13/14	11/26/14	105	14
NSF 15-607	106324	IUSE / Professional Formation of Engineers: REvolutionizing engineering and computer science Departments	8/13/14	12/15/15	489	15
NSF 14-603	106031	Small Business Innovation Research Program Phase I Solicitation	8/21/14	12/2/14	102	14
NSF 14-604	106033	SOCIOLOGY PROGRAM - Doctoral Dissertation Research Improvement Awards	8/27/14	11/25/14	90	14
NSF 14-605	105930	Natural Hazards Engineering Research Infrastructure (2015 - 2019)	8/29/14	12/3/14	96	14

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Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
NSF 14-606	105882	Partnerships for Research and Education in Materials	8/29/14	1/7/15	131	14
NSF 14-607	106028	Ocean Sciences Postdoctoral Research Fellowships	8/29/14	12/8/14	101	14
NSF 14-608	106048	Small Business Technology Transfer Program Phase I Solicitation	9/3/14	12/5/14	92	14
NSF 14-609	106044	Tectonics	9/19/14	1/12/15	116	14
NSF 14-610	106056	Partnerships for Innovation: Building Innovation Capacity	9/22/14	1/28/15	128	14
NSF 14-611	106051	Integrative Strategies for Understanding Neural and Cognitive Systems	9/26/14	1/26/15	122	14
NSF 14-612	106057	Partnerships for Innovation: Accelerating Innovation Research- Research Alliance	9/29/14	2/18/15	143	14

[1] Please note that Program Descriptions are cleared by the Directorates. This appears to be an anomaly as it ist the only PD in this report

NSF FY 2015 Solicitation Publication Data

Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
NSF 15-500	106059	Division of Environmental Biology (core programs)	10/2/14	8/3/15	306	15
NSF 15-501	105973	Postdoctoral Research Fellowships in Biology	10/2/14	1/8/15	98	15
NSF 15-502	106060	EMERGING FRONTIERS AND MULTIDISCIPLINARY ACTIVITIES 2015	10/2/14	4/13/15	193	15
NSF 15-503	106078	Long Term Research in Environmental Biology	10/2/14	8/3/15	305	15
NSF 15-504	106055	Major Research Instrumentation Program:	10/15/14	1/22/15	99	15
NSF 15-505	105998	National Robotics Initiative	10/16/14	1/14/15	90	15
NSF 15-506	106090	Science, Technology, and Society	10/17/14	2/2/15	109	15
NSF 15-507	106079	Scalable Nanomanufacturing	10/22/14	1/20/15	91	15
NSF 15-508	106065	US Ignite	10/23/14	1/21/15	91	15
NSF 15-509	106089	EHR Core Research	10/23/14	2/3/15	103	15
NSF 15-510	106005	United States-Israel Collaboration in Computer Science	10/24/14	3/16/15	143	15
NSF 15-511	106054	Exploiting Parallelism and Scalability	10/24/14	1/27/15	95	15
NSF 15-512	106076	CISE-MPS Interdisciplinary Faculty Program in Quantum Information Science	10/31/14	2/2/15	94	15
PD 15-7685	106087	Benchmarks of Realistic Scientific Application Performance of Large-Scale Computing Systems	11/4/14	2/2/15	90	15
NSF 15-513	106112	Science of Science and Innovation Policy Doctoral Dissertation Research Improvement Grants	11/6/14	2/9/15	96	15
NSF 15-514	106097	Law & Social Sciences	11/7/14	2/4/15	90	15

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Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
NSF 15-515	106040	Algorithms in the Field	11/12/14	2/9/15	90	15
NSF 15-516	106063	Earth Sciences: Instrumentation and Facilities (EAR/IF)	11/12/14	Anytime	Anytime	15
NSF 15-517	106081	EPSCoR Research Infrastructure Improvement Program: Track-2	11/17/14	2/20/15	95	15
NSF 15-519	106085	National Nanotechnology Coordinated Infrastructure	11/18/14	4/3/15	137	15
NSF 15-518	105980	NSF/Intel Partnership on Visual and Experiential Computing	11/18/14	2/20/15	95	15
NSF 15-520	106084	Genealogy of Life	11/20/14	3/25/15	126	15
NSF 15-521	106110	Research on the Science and Technology Enterprise: Statistics and Surveys - R&D, U.S. S&T Competitiveness, STEM Education, S&T Workforce	11/20/14	2/18/15	90	15
PD 15-7396	106132	Engineering for Natural Hazards	11/21/14	Overwritten	Overwritten	Overwritten
NSF 15-522	106052	Materials Innovation Platforms	11/24/14	3/2/15	98	15
NSF 15-523	106117	Resource Implementations for Data Intensive Research in the Social Behavioral and Economic Sciences	11/24/14	2/23/15	91	15
NSF 15-524	106098	Cyber-Innovation for Sustainability Science and Engineering	11/25/14	2/24/15	91	15
NSF 15-525	106120	Management of UNOLS Marine Technician Pool	11/26/14	4/15/15	140	15
NSF 15-526	106118	Improving Undergraduate STEM Education: Pathways into Geoscience	12/1/14	3/16/15	106	15
NSF 15-527	105943	Research Coordination Networks	12/2/14	3/2/15	91	15
NSF 15-528	106113	Cultivating Cultures for Ethical STEM	12/12/14	3/12/15	91	15
PD 15-1392	106138	Integrative Paleoanthropology Grants	12/15/14	4/2/15	109	14
NSF 15-530	106053	Robert Noyce Teacher Scholarship Program	12/16/14	3/17/15	91	15
NSF 15-529	106094	Antarctic Research	12/16/14	4/15/15	120	15
NSF 15-531	106135	Critical Resilient Interdependent Infrastructure Systems and Processes	12/18/14	3/20/15	92	15
NSF 15-532	106127	Science of Learning: Collaborative Networks	12/19/14	3/18/15	90	15
NSF 15-533	106104	Dimensions of Biodiversity FY2015	12/22/14	4/9/15	109	15
NSF 15-534	106088	Campus Cyberinfrastructure - Data, Networking, and Innovation Program	12/22/14	3/24/15	93	15
NSF 15-535	106011	Long Term Ecological Research	1/6/15	5/6/15	120	15
NSF 15-536	106119	Research Experiences for Teachers (RET) in Engineering and Computer Science	1/8/15	4/8/15	90	15
NSF 15-537	106148	STEM + Computing Partnerships	1/9/15	4/14/15	95	15
NSF 15-538	105967	Basic Research to Enable Agricultural Development	1/27/15	4/27/15	91	15
NSF 15-539	106109	Professional Formation of Engineers	1/30/15	4/30/15	91	15
NSF 15-540	106122	Promoting Research and Innovation in Methodologies for Evaluation	1/30/15	4/30/15	91	15
NSF 15-541	106108	Cyber-Physical Systems	2/2/15	5/4/15	91	15
NSF 15-542	106131	National Science Foundation Research Traineeship (NRT) Program	2/5/15	5/6/15	90	15
NSF 15-543	106099	Archiving and Discovering of Data and Metadata Generated through Projects Funded by the NSF Arctic Sciences Section	2/11/15	5/18/15	96	15

NSF FY 2015 Solicitation Publication Data

Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
NSF 15-544	106083	Critical Techniques and Technologies for Advancing Foundations and Applications of Big Data Science & Engineering	2/19/15	5/20/15	90	15
NSF 15-545	106164	Small Business Technology Transfer Program Phase I Solicitation	2/25/15	6/18/15	113	15
NSF 15-546	106157	Small Business Innovation Research Program Phase I Solicitation	2/25/15	6/16/15	111	15
NSF 15-547	106142	Cracking the Olfactory Code	2/27/15	7/31/15	154	15
NSF 15-548	106159	Plant Genome Research Program	2/27/15	5/27/15	90	15
NSF 15-549	106101	Cybersecurity Innovation for Cyberinfrastructure	3/2/15	6/2/15	92	15
NSF 15-550	106143	Enhancing Access to the Radio Spectrum	3/2/15	6/2/15	92	15
NSF 15-551	106145	Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM)	3/6/15	6/19/15	105	15
NSF 15-552	106139	Historically Black Colleges and Universities Undergraduate Program	3/6/15	10/7/15	215	15
NSF 15-553	105887	Software Infrastructure for Sustained Innovation - S2I2	3/6/15	6/3/15	90	15
NSF 15-554	106175	Archaeology Program - Doctoral Dissertation Research Improvement Awards (Arch-DDRI)	3/6/15	Anytime	Anytime	15
NSF 15-555	106168	Faculty Early Career Development Program	3/10/15	7/21/15	134	15
NSF 15-556	106172	Cultural Anthropology Program - Doctoral Dissertation Research Improvement Grants	3/11/15	8/17/15	160	15
PD 15-7569	106141	Dynamics, Control and Systems Diagnostics	3/13/15	Overwritten	Overwritten	Overwritten
NSF 15-557	106173	Petrology and Geochemistry	3/16/15	7/10/15	116	15
NSF 15-558	106130	Hydrologic Sciences	3/18/15	Anytime	Anytime	15
NSF 15-560	106137	Geomorphology and Land-use Dynamics (GLD)	3/23/15	Anytime	Anytime	15
NSF 15-559	106128	Geobiology and Low-Temperature Geochemistry (GG)	3/23/15	Anytime	Anytime	15
NSF 15-561	106129	Sedimentary Geology and Paleobiology (SGP)	3/27/15	Anytime	Anytime	15
NSF 15-562	106151	Big Data Regional Innovation Hubs	3/27/15	6/24/15	90	15
NSF 15-563	106103	Building Community and Capacity in Data Intensive Research in Education	4/8/15	9/1/15	146	15
PD 15-1699	106190	Cognitive Neuroscience	4/14/15	8/13/15	122	15
NSF 15-564	106185	GeoPRISMS Program	4/15/15	7/15/15	91	15
NSF 15-565	106178	Consortium for Advanced Manufacturing Foresights: Defining the Critical Needs of the Advanced Manufacturing Research Community	4/21/15	7/20/15	90	15
PD 15-7244	106205	Computational Physics	4/28/15	Overwritten	Overwritten	Overwritten
NSF 15-566	106202	EPSCoR Research Infrastructure Improvement Program Track-1:	5/5/15	8/4/15	92	15
NSF 15-567	106183	Documenting Endangered Languages	5/5/15	9/15/15	133	15
NSF 15-568	106197	NSF Earth Sciences Postdoctoral Fellowships	5/12/15	1/12/16	246	15

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Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
NSF 15-569	106204	Computer and Information Science and Engineering (CISE) Research Initiation Initiative	5/22/15	9/30/15	131	15
NSF 15-570	106215	Partnerships for Innovation: Accelerating Innovation Research- Technology Translation	5/27/15	10/9/15	135	15
NSF 15-571	106220	Political Science Doctoral Dissertation Research Improvement Grants	5/29/15	8/28/15	91	15
NSF 15-572	106194	Computer and Network Systems (CNS): Core Programs	6/1/15	9/16/15	107	15
NSF 15-573	106196	Computing and Communication Foundations (CCF): Core Programs	6/1/15	9/16/15	107	15
NSF 15-574	106191	Information and Intelligent Systems (IIS): Core Programs	6/1/15	9/16/15	107	15
NSF 15-575	106195	Secure and Trustworthy Cyberspace	6/1/15	9/16/15	107	15
NSF 15-576	106200	Advancing Digitization of Biodiversity Collections	6/2/15	10/9/15	129	15
NSF 15-577	106212	Collections in Support of Biological Research	6/9/15	9/10/15	94	15
NSF 15-578	106208	EarthScope	6/11/15	11/13/15	155	15
NSF 15-580	106211	Mid-Scale Innovations Program in Astronomical Sciences (MSIP)	6/18/15	2/22/16	249	15
NSF 15-581	106146	NSF Scholarships in Science, Technology, Engineering, and Mathematics	6/24/15	9/22/15	90	15
NSF 15-582	105976	Advances in Biological Informatics	6/24/15	9/22/15	90	15
NSF 15-583	106233	Science of Science and Innovation Policy Doctoral Dissertation Research Improvement Grants	6/25/15	9/29/15	96	15
NSF 15-584	106213	CyberCorps(R) Scholarship for Service	6/26/15	9/25/15	91	15
NSF 15-585	106187	Improving Undergraduate STEM Education: Education and Human Resources	6/26/15	11/3/15	130	15
NSF 15-586	106073	Restricted-Access Research Data Centers	7/1/15	9/30/15	92	15
NSF 15-587	106186	Management and Operation of the IceCube Neutrino Observatory (ICNO)	7/8/15	10/7/15	91	15
NSF 15-588	106174	Interdisciplinary Behavioral and Social Science Research	7/13/15	12/1/15	141	15
NSF 15-589	106225	Gen-3 Engineering Research Centers	7/22/15	6/16/16	330	15
PD 15-7643	106243	Environmental Sustainability	7/23/15	10/20/15	90	15
PD 15-1406	106241	Thermal Transport Processes	7/23/15	10/20/15	90	15
PD 15-1407	106237	Combustion and Fire Systems	7/23/15	10/20/15	90	15
PD 15-7909	106269	Nano-Biosensing	7/23/15	10/20/15	90	15
PD 15-7236	106247	Biophotonics	7/23/15	10/20/15	90	15
PD 15-1491	106249	Biotechnology and Biochemical Engineering	7/23/15	10/20/15	90	15
PD 15-1403	106238	Process Systems, Reaction Engineering and Molecular Thermodynamics	7/23/15	10/20/15	90	15
PD 15-1415	106239	Particulate and Multiphase Processes	7/23/15	10/20/15	90	15
PD 15-1440	106244	Environmental Engineering	7/23/15	10/20/15	90	15
PD 15-1401	106248	Catalysis and Biocatalysis	7/23/15	10/20/15	90	15
PD 15-1443	106268	Fluid Dynamics	7/23/15	Overwritten	Overwritten	Overwritten
PD 15-5342	106270	General & Age-Related Disabilities Engineering (GARDE)	7/23/15	10/20/15	90	15
PD 15-7644	106245	Energy for Sustainability	7/23/15	10/20/15	90	15

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Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
PD 15-1179	106242	Nano-Bio Phenomena and Processes in the Environment	7/23/15	Overwritten	Overwritten	Overwritten
NSF 15-590	106236	CISE Research Infrastructure	7/23/15	1/20/16	181	15
NSF 15-591	106262	Ideas Lab: Measuring "Big G" Challenge	7/28/15	1/14/16	171	15
NSF 15-592	106271	Discovery Research PreK-12	7/28/15	12/7/15	133	15
NSF 15-593	106228	Advancing Informal STEM Learning	7/28/15	11/4/15	100	15
NSF 15-594	106259	Louis Stokes Alliances for Minority Participation	7/29/15	11/4/15	98	15
NSF 15-595	106274	Collaborative Research in Computational Neuroscience	7/31/15	10/29/15	90	15
NSF 15-596	106180	Long-Term Ecological Research	7/31/15	3/4/16	217	15
NSF 15-597	106266	Graduate Research Fellowship Program[2]	8/3/15	10/26/15	84	15
NSF 15-598	106219	Natural Hazards Engineering Research Infrastructure	8/3/15	11/4/15	93	15
NSF 15-599	106265	Innovative Technology Experiences for Students and Teachers	8/5/15	11/13/15	100	15
NSF 15-600	106297	Integrated Earth Systems	8/11/15	11/16/15	97	15
NSF 15-601	106263	NSF/DOE Partnership in Basic Plasma Science and Engineering	8/19/15	11/19/15	92	15
NSF 15-602	106292	Resource Implementations for Data Intensive Research in the Social Behavioral and Economic Sciences	8/20/15	2/29/16	193	15
NSF 15-603	106272	EarthCube: Enterprise Governance	8/27/15	12/14/15	109	15
NSF 15-604	106293	Small Business Technology Transfer Program Phase I	9/2/15	12/11/15	99	15
NSF 15-605	106279	Small Business Innovation Research Program Phase I	9/2/15	12/8/15	96	15
NSF 15-606	106303	Solar, Heliospheric, and INterplanetary Environment	9/9/15	12/9/15	91	15
NSF 15-608	106281	Designing Materials to Revolutionize and Engineer our Future	9/15/15	1/19/16	127	15
NSF 15-609	106312	Division of Environmental Biology (core programs)	9/16/15	8/2/16	321	15
NSF 15-610	106294	Partnerships for Innovation: Building Innovation Capacity	9/18/15	1/29/16	133	15
NSF 15-611	106295	Dimensions of Biodiversity FY2016	9/29/15	3/17/16	170	15

[2] This Request for exemption of the 90 day requirement was approved by Richard Buckius, Acting Chief Operating Officer, on 8/3/15.

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Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
NSF 16-500	106320	Long Term Research in Environmental Biology	10/2/15	8/2/16	305	16
NSF 16-501	106316	Focused Research Hubs in Theoretical Physics	10/2/15	1/27/16	117	16
NSF 16-502	106278	EMERGING FRONTIERS IN RESEARCH AND INNOVATION 2016	10/8/15	4/8/16	184	16
NSF 16-503	106317	National Science Foundation Research Traineeship (NRT) Program	10/14/15	2/9/16	119	16
NSF 16-504	106222	Industry/University Cooperative Research Centers Program	10/14/15	1/11/16	90	16
NSF 16-505	106286	Division of Integrative Organismal Systems 	10/14/15	6/1/16	231	16
NSF 16-506	106042	Improvements in Facilities, Communications, and Equipment at Biological Field Stations an	10/14/15	1/11/16	90	16
NSF 16-507	106296	Exploiting Parallelism and Scalability	10/19/15	1/19/16	92	16
NSF 16-508	106325	Integrative Strategies for Understanding Neural and Cognitive Systems	10/20/15	1/27/16	100	16
PD 16-1468	106343	Manufacturing Machines and Equipment	10/21/15	Overwritten	Overwritten	Overwritten
NSF 16-509	106299	Long-Term Ecological Research (LTER)	10/28/15	8/2/16	280	16
NSF 16-510	106341	Big Data Regional Innovation Hubs: Establishing Spokes to Advance Big Data Applications	10/30/15	2/25/16	119	16
NSF 16-511	106340	EPSCoR Research Infrastructure Improvement Program: Track-2 Focused EPSCoR Collab	11/5/15	2/4/16	91	16
NSF 16-512	106300	Critical Techniques, Technologies and Methodologies for Advancing Foundations and Appli	11/9/15	2/9/16	92	16
NSF 16-513	106342	Scalable Nanomanufacturing	11/10/15	2/16/16	98	16
NSF 16-514	106333	EarthCube: Developing a Community-Driven Data and Knowledge Environment for the Geos	12/1/15	3/24/16	114	16
NSF 16-515	106332	Algorithms in the Field	12/3/15	3/3/16	91	16
NSF 16-516	106352	GEO Opportunities for Leadership in Diversity	12/4/15	6/2/16	181	16
NSF 16-517	106275	National Robotics Initiative	12/9/15	3/7/16	90	16
NSF 16-518	106329	NSF/CASIS Collaboration on Fluid Dynamics Research on the International Space Station tc	12/9/15	3/7/16	90	16
NSF 16-519	106363	Critical Resilient Interdependent Infrastructure Systems and Processes	12/11/15	3/9/16	90	16
NSF 16-520	106358	Ideas Lab: Measuring "Big G" Challenge	12/11/15	10/26/16	320	16
NSF 16-521	106347	MacroSystems Biology and Early NEON Science	12/17/15	3/15/16	90	16
NSF 16-522	106322	Genealogy of Life FY2016	12/17/15	3/23/16	97	16
NSF 16-523	106321	International Research Network Connections	12/17/15	3/17/16	91	16
NSF 16-524	106290	Innovations at the Nexus of Food, Energy and Water Systems	12/21/15	3/22/16	92	16
NSF 16-525	106203	Centers of Research Excellence in Science and Technology (CREST) and HBCU Research	12/28/15	6/10/16	165	16
NSF 16-526	106216	Energy-Efficient Computing: from Devices to Architectures	12/29/15	3/28/16	91	16
NSF 16-527	106374	STEM + Computing Partnerships	12/30/15	3/28/16	90	16
NSF 16-528	106365	Science of Learning: Collaborative Networks	12/30/15	4/4/16	96	16
NSF 16-529	106298	Petascale Computing Resource Allocations	1/4/16	4/4/16	91	16
NSF 16-530	106345	Data Infrastructure Building Blocks	1/5/16	4/4/16	90	16
NSF 16-531	106179	Tribal Colleges and Universities Program	1/12/16	4/14/16	93	16
NSF 16-532	106326	Software Infrastructure for Sustained Innovation	1/19/16	4/26/16	98	16

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NSF 16-533	106362	Cybersecurity Innovation for Cyberinfrastructure	1/20/16	4/19/16	90	16
NSF 16-534	106367	Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PA	1/21/16	6/17/16	148	16
NSF 16-535	106381	Expeditions in Computing	2/2/16	1/18/17	352	16
NSF 16-536	106382	Sedimentary Geology and Paleobiology (SGP)	2/2/16	Anytime	Anytime	16
NSF 16-537	106360	Enhancing Access to the Radio Spectrum	2/4/16	5/3/16	90	16
NSF 16-538	106368	Historically Black Colleges and Universities Undergraduate Program	2/9/16	10/4/16	238	16
NSF 16-539	106149	Innovation Corps - National Innovation Network Nodes Program	2/11/16	5/10/16	90	16
NSF 16-540	106373	NSF Scholarships in Science, Technology, Engineering, and Mathematics	2/16/16	5/16/16	90	16
NSF 16-541	106388	Antarctic Research	2/16/16	5/16/16	90	16
NSF 16-542	106383	Antarctic Artists and Writers Program	2/16/16	6/1/16	106	16
NSF 16-543	106344	Joint DMS/NIGMS Initiative to Support Research at the Interface of the Biological and Mathen	2/22/16	9/14/16	205	16
NSF 16-544	106396	Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers i	2/22/16	6/24/16	123	16
NSF 16-545	106380	Materials Research Science and Engineering Centers	2/25/16	12/2/16	282	16
NSF 16-546	106387	Management and Operation of the National Geophysical Observatory for Geoscience	2/25/16	12/30/16	310	16
NSF 16-547	106379	Innovation Corps- National Innovation Network Sites Program	2/26/16	5/25/16	90	16
NSF 16-548	106288	Science Learning+ Partnership Grants	2/26/16	6/14/16	109	16
NSF 16-549	106369	Cyber-Physical Systems	3/1/16	6/7/16	98	16
NSF 16-550	106392	Conferences and Workshops in the Mathematical Sciences	3/3/16	Anytime	Anytime	16
NSF 16-551	106348	Plant-Biotic Interactions	3/7/16	6/6/16	91	16
NSF 16-552	106364	Alliances for Graduate Education and the Professoriate	3/11/16	6/14/16	95	16
PD 16-018Y	106403	Cybermanufacturing Systems (CM)	3/14/16	Anytime	Anytime	16
NSF 16-553	106376	US Ignite:	3/16/16	6/14/16	91	16
NSF 16-554	106400	Small Business Innovation Research Program Phase I	3/17/16	6/16/16	91	16
NSF 16-555	106402	Small Business Technology Transfer Program Phase I (STTR)	3/17/16	6/20/16	95	16
NSF 16-556	106411	Tectonics	3/31/16	7/8/16	99	16
NSF 16-557	106406	EPSCoR Research Infrastructure Improvement Program Track-1:	3/31/16	8/2/16	124	16
NSF 16-558	106423	Mathematical Sciences Postdoctoral Research Fellowships	4/20/16	10/19/16	183	16
NSF 16-559	106390	Robert Noyce Teacher Scholarship Program	4/20/16	9/6/16	139	16
PD 16-7607	106308	Energy, Power, Control, and Networks	4/24/16	11/1/16	190	16
PD 16-1517	106309	Electronics, Photonics and Magnetic Devices	4/24/16	11/1/16	191	16
NSF 16-560	106408	GeoPRISMS Program	4/25/16	7/26/16	93	16
PD 16-7564	106307	Communications, Circuits, and Sensing-Systems	4/26/16	11/1/16	188	16
NSF 16-561	106416	Physics Frontiers Centers	5/3/16	1/30/17	272	16
NSF 16-562	106393	Prediction of and Resilience against Extreme Events	5/5/16	9/20/16	139	16

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Program Anouncement ID	PIMS Publication ID	Program Title	Publication Date	First Full Prop Deadline Date	Difference Btw Publication & Deadline	Fiscal Year Published
NSF 16-563	106391	Curatorial Stewardship of a National Collection of Geological Rock & Sediment Cores from .	5/6/16	8/3/16	90	16
NSF 16-564	106433	NSF/DOE Partnership in Basic Plasma Science and Engineering	5/9/16	10/21/16	165	16
NSF 16-565	106427	Computer and Information Science and Engineering (CISE) Research Initiation Initiative	5/12/16	8/10/16	90	16
NSF 16-566	106417	Division of Physics: Investigator-Initiated Research Projects	5/16/16	10/26/16	163	16
NSF 16-567	106405	Campus Cyberinfrastructure	5/23/16	8/23/16	92	16
NSF 16-568	106397	Centers for Chemical Innovation	5/25/16	10/11/16	139	16
NSF 16-569	106378	Developing a National Research Infrastructure for Neuroscience	5/26/16	10/21/16	148	16
NSF 16-570	106441	Origin of Life	6/6/16	12/19/16	196	16
NSF 16-571	106398	Partnerships for International Research and Education	6/17/16	4/24/17	312	16
NSF 16-572	106455	Cooperative Studies Of The Earth's Deep Interior	6/17/16	9/27/16	102	16
NSF 16-573	106407	Joint NSF/NIH Initiative on Quantitative Approaches to Biomedical Big Data	6/20/16	9/28/16	101	16
NSF 16-574	106401	Astronomy and Astrophysics Research Grants	6/24/16	11/15/16	145	16
NSF 16-575	106428	NSF Astronomy and Astrophysics Postdoctoral Fellowships	6/28/16	10/12/16	106	16
NSF 16-576	106440	Documenting Endangered Languages	6/28/16	9/26/16	90	16
NSF 16-577	106421	Focused Research Groups in the Mathematical Sciences	6/29/16	9/27/16	91	16
NSF 16-578	106414	Computing and Communication Foundations (CCF): Core Programs	7/5/16	10/19/16	106	16
NSF 16-579	106435	Computer and Network Systems (CNS): Core Programs	7/5/16	10/19/16	106	16
NSF 16-580	106434	Secure and Trustworthy Cyberspace	7/5/16	10/19/16	106	16
NSF 16-581	106409	Information and Intelligent Systems (IIS): Core Programs	7/5/16	10/19/16	106	16
NSF 16-582	106424	NSF/VMware Partnership on Software Defined Infrastructure as a Foundation for Clean-Slat	7/8/16	10/5/16	90	16
NSF 16-583	106458	Partnerships for Innovation: Accelerating Innovation Research- Technology Translation	7/12/16	10/11/16	91	16
NSF 16-584	106420	Improving Undergraduate STEM Education: Pathways into Geoscience	7/13/16	10/11/16	90	16
NSF 16-585	106463	Platforms for Advanced Wireless Research (PAWR): Establishing the PAWR Project Office (I	7/14/16	11/23/16	132	16
NSF 16-586	106454	NSF/Intel Partnership on Information-Centric Networking in Wireless Edge Networks	7/14/16	11/21/16	130	16
NSF 16-587	106443	Wireless Innovation between Finland and US	7/14/16	10/17/16	95	16
NSF 16-588	106459	Graduate Research Fellowship Program	7/18/16	10/24/16	99	16
NSF 16-589	106438	Integrated Earth Systems	8/11/16	11/14/16	95	16
PD 16-7222	106513	Crosscutting Activities Program in Materials Research (XC)	8/12/16	Anytime	Anytime	16
NSF 16-590	106511	SBE Postdoctoral Research Fellowships	8/17/16	11/14/16	90	16
NSF 16-591	106466	Partnerships for Innovation: Building Innovation Capacity	8/18/16	11/16/16	91	16
NSF 16-592	106437	Ecology and Evolution of Infectious Diseases	8/18/16	11/16/16	91	16
NSF 16-593	106464	Network for Computational Nanotechnology (NCN)	8/24/16	12/2/16	100	16
NSF 16-594	106415	ADVANCE: Increasing the Participation and Advancement of Women in Academic Science a	8/26/16	1/11/17	138	16
NSF 16-595	106394	Arctic Research Opportunities Arctic Natural Sciences; Arctic Social Sciences; Arctic System	8/29/16	Anytime	Anytime	16

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NSF 16-596	106521	Condensed Matter and Materials Theory (CMMT)	8/31/16	Anytime	Anytime	16
NSF 16-597	106518	Ceramics (CER)	8/31/16	Anytime	Anytime	16
NSF 16-598	106526	Geophysics	8/31/16	12/9/16	101	16
NSF 16-599	106498	Small Business Innovation Research Program Phase I	9/8/16	12/6/16	90	16
NSF 16-600	106530	Small Business Technology Transfer Program Phase I	9/8/16	12/6/16	90	16
NSF 16-601	106467	Smart and Connected Health	9/9/16	12/8/16	90	16
NSF 16-602	106461	Solar and Planetary Research Grants (SPG)	9/9/16	Anytime	Anytime	16
PD 16-004Y	106502	Science of Learning	9/12/16	1/18/17	128	16
NSF 16-603	106515	Algorithms in the Field	9/14/16	1/26/17	134	16
NSF 16-604	106534	Scalable Nanomanufacturing for Integrated Systems	9/14/16	1/13/17	121	16
NSF 16-605	106507	Scalable Parallelism in the Extreme	9/15/16	1/10/17	117	16
NSF 16-606	106468	NSF/Intel Partnership on Computer Assisted Programming for Heterogeneous Architectures	9/16/16	12/15/16	90	16
NSF 16-607	106506	Collaborative Research in Computational Neuroscience	9/19/16	12/19/16	92	16
NSF 16-608	106474	Smart and Autonomous Systems	9/21/16	12/19/16	90	16
NSF 16-609	106546	Earth Sciences: Instrumentation and Facilities (EAR/IF)	9/23/16	Anytime	Anytime	16
NSF 16-610	106532	Smart and Connected Communities	9/23/16	2/16/17	147	16
NSF 16-611	106431	Earth Sciences: Laboratory Technician Support	9/23/16	2/9/17	140	16
NSF 16-612	106491	EMERGING FRONTIERS IN RESEARCH AND INNOVATION 2017	9/23/16	3/24/17	182	16
NSF 16-613	106503	Designing Materials to Revolutionize and Engineer our Future	9/23/16	1/17/17	116	16
NSF 16-614	106436	Plant Genome Research Program (PGRP)	9/26/16	Anytime	Anytime	16
NSF 16-615	106505	Transdisciplinary Research in Principles of Data Science Phase I	9/27/16	3/15/17	170	16
NSF 16-616	106456	Spectrum Efficiency, Energy Efficiency, and Security (SpecEES): Enabling Spectrum for All	9/27/16	1/19/17	114	16
NSF 16-617	106452	Documenting Endangered Languages - Doctoral Dissertation Research Improvement Gran	9/28/16	Anytime	Anytime	16
NSF 16-618	106523	Critical Resilient Interdependent Infrastructure Systems and Processes FY17	9/30/16	2/8/17	131	16
PD 16-014Y	106132	Engineering for Natural Hazards	Overwritten	Overwritten	Overwritten	Overwritten
PD 16-1179	106242	Biological and Environmental Interactions of Nanoscale Materials	Overwritten	Overwritten	Overwritten	Overwritten
PD 16-7244	106205	Computational Physics	Overwritten	12/3/15	Overwritten	Overwritten

THURSDAY, JUNE 8, 2017.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WITNESS

ROBERT M. LIGHTFOOT, JR., ACTING ADMINISTRATOR, NASA

CHAIRMAN'S OPENING REMARKS

Mr. CULBERSON. The Commerce, Justice, Science Appropriations Subcommittee will come to order.

We are very pleased to have with us today Robert Lightfoot, the acting administrator of NASA. Robert, we sincerely appreciate your service to the Nation, your devoted service to NASA, and keeping the American space program the best on Earth over these many years.

We have in fiscal year 2018 a request from the administration to fund NASA at $19.1 billion. This request from the Office of Management and Budget is a request $561 million below the recently enacted 2017 fiscal year level of $19.7 billion.

When it comes to NASA, Mr. Administrator, this subcommittee works arm in arm. The country and Congress are very proud of the work that NASA does. I am really pleased to have the full support of the subcommittee in getting a record level of funding to NASA. In the brief time that I have had the privilege of chairing this subcommittee, we have been able to take NASA to record levels of funding.

Last year's level included $184 million in emergency funding to address the damage that occurred at NASA facilities at Michoud and at the Cape as a result of a hurricane and tornado. That was, I know, an important part of keeping NASA whole and allowing you to focus your efforts on space flight.

This Congress has provided really significant increases to NASA. You have been underfunded for far too long. Too much has been on NASA's plate, and you haven't had enough funds to do everything that you have been asked to do. But that is changing.

As you have seen with the last several appropriations, NASA has grown from $18.1 billion in funding from—in 2015 to almost $20 billion in fiscal year 2017. It is an indication of the level of confidence and admiration that the Congress and the American people have in you and the good people at NASA. We have been able to provide NASA with growth at these levels, when other agencies of the Federal Government have seen their budgets held flat and even cut or eliminated.

Of course, increased funding requires increased responsibility. Our constituents' hard earned and very scarce and precious tax dollars need to be spent wisely, prudently, and carefully. And the subcommittee expects that you and everyone at NASA will ensure that the money our constituents work so hard to earn is used frugally.

We have, in the 2017 appropriations bill, made sure that the SLS rocket is fully funded, the Orion program is fully funded, that the agency has the funds that you need to put humans back into deep space. The commercial sector is funded at a level it should be in the 2017 bill.

I like to think of what the commercial providers are doing is sort of like stepping out in front of your office building and catching a cab. In years to come, you should be able to catch a commercial provider to take you to low Earth orbit as easily as you can catch an Uber, Lyft or yellow cab. NASA will then be responsible for deep-space travel. I think it is a good way to think about the distinction and the difference between them.

In addition to fully funding the human space flight program, as you have seen in the 2017 bill and in previous bills I have had the privilege of chairing in the subcommittee. The committee made certain that the Decadal Survey recommendations of the American Academy of Sciences are funded in each one of the major categories because we want to see NASA fund and fly those top recommendations of the Decadal Survey, and, in particular, when it comes to planetary science, which was badly underfunded for too many years. The committee included a directive to NASA, a statutory directive that NASA fund and fly a mission, an orbiter and a lander to Jupiter's icy moon Europa. It is one place nearest to home that the scientific community believes we are most likely to find life on another world for the first time in human history. I look forward to hearing an update on how the Europa mission is going.

Finally, I want to direct your attention to language included in the 2017 bill directing NASA to identify the nearest Earth-like planet around the nearest star, to characterize that nearby planet's atmosphere looking for signs of life, methane, carbon dioxide, oxygen. As John Grunsfeld once told me, perhaps the sensitivity would be such that we might even detect industrial pollution in the atmosphere of a nearby planet. Then to directing NASA to develop interstellar rocket propulsion achieving 10 percent of the speed of light and then launch a humanities first mission to that nearest Earth-like planet no later than the 100th anniversary of Neil Armstrong setting foot on the moon in 2069.

In the time it has been my privilege to represent the people of west Houston in District 7, I have enjoyed my service on this subcommittee immensely. An important part of that has been the friendship and close cooperation that I have developed with my good friend from New York, Mr. Serrano. I am really pleased to have you back as our ranking member. We work together so well, and he is as passionate a supporter of the space program as I am.

And I am pleased to recognize the gentleman from New York for any opening remarks he would like to make.

Ranking Member Opening Remarks

Mr. Serrano. Thank you, Mr. Chairman.

And I also welcome the administrator to the subcommittee hearing today.

NASA is in charge of conducting civilian space activities and science and aeronautics research. I am a strong supporter of NASA and believe that its programs help America maintain itself as the world leader in space exploration and in the scientific arenas that develop those technologies. Not only do NASA's missions inspire so many people around the world, but they also help us innovate and address challenges that confront our Nation.

The President's budget blueprint for fiscal year 2018 requests $19.1 billion for NASA, which is a $532.8 million decrease from the 2017 enacted level. While NASA was not cut as much as other agencies under the jurisdiction of our subcommittee, the budget proposal reduces funding for a number of important areas.

I am particularly concerned that although funding is continued for the education activities of NASA's Science Mission Directorate, this request zeroes out funding for three longstanding programs within NASA's Office of Education, an office that helps inspire the next generation of scientists.

I strongly oppose the elimination of these programs, Mr. Chairman, and I hope that we can work together in a bipartisan manner to preserve these programs that so greatly benefit the American people.

I would further like to call attention to the President's request for Earth Science, which is cut of $166.9 million below fiscal year 2017. In addition to eliminating several individual Earth Science missions, which are necessary in our efforts to combat climate change, the request will reduce funding for Earth Science external grants.

We need to place a high priority on NASA's Earth Science research, and I look forward to discussing this topic further today.

I also look forward to hearing from Acting Administrator Lightfoot on NASA's long-term plans for human space exploration, which will require significant amounts of money for research on advanced communications; entry, descent, and landing capabilities; and ways to protect astronauts' health during those long deep-space missions, among other things.

All of these improvements will require massive amounts of money over a long period of time, at a time when Federal non-defense discretionary spending has been decreasing as a share of the economy.

Mr. Chairman, as you very well know, I am also a strong supporter of the Arecibo Observatory and believe that we must maintain strong support for its mission. NASA's 2018 budget request includes funding for NASA activities at the observatory, and I would like to hear more about this work.

Before I conclude, we cannot discuss NASA's budget request, Mr. Chairman, without discussing the overall budget picture. As I mentioned at yesterday's hearing, I believe that we must have a serious discussion regarding budget caps and President Trump's larger budget request. The President proposes an increase of $54 billion in defense spending funded by an equal decrease in non-defense discretionary spending. Quite frankly, implementing such a proposal undermines America's competitiveness, economic opportunity, and domestic security.

Agencies like NASA are being put at risk by this unbalanced proposal, as evidenced by the unwise cuts in the NASA budget request. Our Nation's leadership in a number of important areas is threatened by this budget request, and we need to recognize that if we want our Nation to be at the forefront of innovation and job creation, we need a much wiser fiscal policy.

And I am sorry for repeating myself, but I think that committees like ours deserve a better allocation as we go along, and the moving of $54 billion will hamper that in many ways.

Thank you, Mr. Chairman.

Mr. CULBERSON. Thank you very much, Mr. Serrano.

Mr. Lightfoot, we are delighted to have you with us here today. Your written statement will be entered into the record in its entirety, if there is no objection. And I welcome you to briefly summarize your statement. And thank you again for your service to the country.

ACTING ADMINISTRATOR'S OPENING REMARKS

Mr. LIGHTFOOT. OK. Thank you, Mr. Chairman and members of the subcommittee. I am pleased to have this opportunity to discuss our budget, our FY 2018 budget request.

We really appreciate the subcommittee's support, especially your bipartisan commitment to what we call our constancy of purpose in NASA.

The FY 2017 Consolidated Appropriations Act, and specifically the emergency supplemental, as you mentioned earlier, were critical to us to keep the operations at Kennedy and Michoud assembly facility going. So we really appreciate that, your hard work on our behalf.

NASA's historic and enduring purpose can be summarized into three major strategic themes: discover, explore, and develop. These correspond to our missions of scientific discovery, exploration, and new technology development in aeronautics and space systems. NASA missions also inspire the next generation. They inject innovation into the national economy and they provide critical information to address national challenges and support global engagement and international leadership.

The FY 2018 request of $19.1 billion supports a vigorous program that leads the world in space and aeronautics. While we had to make some difficult decisions with regard to Earth Science and education, this remains a good budget for NASA.

NASA advances U.S. global leadership in aeronautics by developing and transferring key enabling technologies. In FY 2018, NASA will award a contract for detailed aircraft design, build, and validation of a low-boom flight demonstrator, which will demonstrate quiet overland supersonic flight opening a new market in the U.S. industry.

In science, NASA is currently using our 20 space-borne missions to study the Earth as a system, which supply Earth Science data for weather forecasting, farming, water management, disaster response, and even disease early warning.

The request also supports two new missions by the end of 2018. The GRACE-Follow-on will track water across the planet precisely measuring Earth's gravitational field, and ICESat-2 will measure ice sheets, clouds, and vegetation canopy heights.

In September, Cassini will make the final series of 22 daring dives through the 1,500-mile wide gap between the planet and its inner rings as part of its grand finale of end-of-mission maneuvers.

OSIRIS–REx on its way to the asteroid Bennu will conduct a search for elusive objects known as Earth-Trojan asteroids, and in 2023 will return a sample from Bennu back to Earth for analysis.

In 2018, we will launch the Mars InSight lander to study the interior structure of Mars and are on track to launch the next Mars rover mission in 2020, and we continue to develop the Europa Clipper mission, which will further search for life beyond Earth.

The James Webb Space Telescope continues on schedule for its 2018 launch. The Webb will be a giant leap forward in our quest to understand the universe and our origins.

In 2018, we will launch the recently named Parker Solar Probe on a mission to fly closer to the Sun than any previous mission. Parker will join 18 other missions dedicated to studying our nearest star.

NASA's space technology request includes investments in deep space optical communication, high power solar electric propulsion technologies, and advanced materials. In late 2017, both the Green Propellant Infusion Mission spacecraft and the Deep Space Atomic Clock instrument will be delivered to orbit.

The International Space Station, our first step on the road to deep-space exploration, is delivering the knowledge and the technology we need to keep astronauts safe, healthy, and productive on deep-space missions of increasing durations.

Working with our commercial crew partners, NASA plans to return crew launch capability to American soil in 2018. We are continuing the development of the Space Launch System rocket, the Orion crew capsule, and the exploration ground systems, and the technology and research needed to support a robust exploration program.

In 2019, we plan to launch an uncrewed exploration mission called EM–1 using the new Space Launch System with Orion on a mission to lunar orbit. A crewed mission, EM–2, will follow not later than 2023.

In the early to mid-2020s, we will develop and deploy critical life support and habitation systems leading to a crewed mission beyond the Earth-Moon system. Missions launched on the Space Launch System in the 2020s will establish the capability to operate safely and productively in deep space.

With your continued support, we look forward to extending human presence into deep space, exploring potentially habitable environments around the solar system, and deepening our understanding of our own home planet, pushing our observations of the universe back to the time when first stars were forming and opening the space frontier.

Mr. Chairman, I will be pleased to respond to your questions and those of other members of the subcommittee. Thank you.

SPACE LAUNCH SYSTEM DEVELOPMENT

Mr. CULBERSON. Thank you very much, Mr. Lightfoot.

So you believe the funding levels that the committee has provided NASA over these last several years are sufficient to keep SLS on track. The delays that you are seeing are not a result of inadequate funding; they are a result of some technical challenges. Is that correct?

Mr. LIGHTFOOT. Yes, sir. We are struggling with what I call the normal development activities when we are trying to put hardware together for the first time. The tornado didn't help. I don't think that was a funding issue. You guys helped us by giving us the funding.

But the weld schedule on the Space Launch System, some of the challenges we are having with the European service module in support of Orion and some software challenges down at the cape. They are not anything Earth shattering in my mind. They are the typical——

Mr. CULBERSON. Normal.

Mr. LIGHTFOOT [continuing]. Development activities we are having to go through. We wish we didn't have them, but we are learning as we go for the first-time build.

Mr. CULBERSON. And you are confident you can meet the launch schedule you have laid out here for the committee for SLS?

Mr. LIGHTFOOT. Correct.

Mr. CULBERSON. Terrific.

PLANETARY SCIENCE

The subcommittee has provided robust support for the planetary science program to ensure that NASA can maintain a good cadence of launches for the discovery class missions, new frontiers, and flagship missions. Does the level of funding provided by the subcommittee the last few years give you sufficient funding to make sure that you can launch missions in each one of those major categories that meet the Decadal Survey recommendations?

Mr. LIGHTFOOT. We believe so. We have good progress on Europa Clipper. And per the 2017 appropriations, we are going to be announcing the instruments for the lander and going toward a mission concept review this summer.

Mr. CULBERSON. How soon?

Mr. LIGHTFOOT. This summer.

Mr. CULBERSON. This summer.

Mr. LIGHTFOOT. We seem to be moving really well on planetary. Helio, I talked about what we are going to do there as well. I am pretty confident that we have got the appropriations we need.

Mr. CULBERSON. OK. Good.

The Europa Clipper and Lande missions are extraordinarily important, the reason they both appear in the statutory bill language is because the science community believes we have the best chance of discovering life in another world in Europe.

So I really appreciate the support that headquarters has given to that mission. It is going to be a turning point in human history when we discover life for the first time in another world. In addition, it makes the SLS even more essential, because a deep-space mission like that with a large flagship-class spacecraft, such as the Clipper and the Lander, require the SLS.

Talk to me about the timeframe for when you expect Clipper to be ready to launch and the lander.

Mr. LIGHTFOOT. Yes, sir. In the 2018 budget that we proposed, we expect a Clipper in the mid-2020s that is when we expect it to go. Of course, you know that in the 2018 budget there is nothing in there for the lander. It is part of the balancing that we had to do.

We had two flagship missions, the March 2020 and the Clipper in there. We have to work the balance on that for the lander piece.

Mr. CULBERSON. But, of course, the lander is in law.

Mr. LIGHTFOOT. Oh, yes. We are going to continue what we did—it is what you said what we were told to do in 2017.

Mr. CULBERSON. Yes, sir. You have got adequate funding for it.

Now, there is another reason the lander is important, not only—because when we—Mr. Serrano is exactly right. The future missions that—the scale of the human space flight program, the SLS program is going to require significant amounts of money over a sustained period of time. I am convinced when the public—when we make that remarkable discovery of life in another world, it will reinvigorate the public's already deep admiration for NASA and allow us to have enough money for the program for the future. That is another important part of that Europa mission.

Could you tell us about—we were very grateful that the Agency has put together an ocean worlds program as directed by the subcommittee's bill to explore Enceladus, moon of Saturn, and Titan and some of the other ocean worlds of the outer solar system.

Could you talk to us about any—are there, for example, NEW FRONTIERS—is there a new frontiers mission being considered for Enceladus? Talk to us a little bit about why Enceladus is important.

Mr. LIGHTFOOT. Well, obviously, Enceladus is important for the same reason Europa is. We think it is a place where we could find some of the origins of life or different life that could be there. The NEW FRONTIERS program is going to stay on its standard cadence that we will put out here shortly, and we think we have got the money to do that as——

Mr. CULBERSON. Every other year?

Mr. LIGHTFOOT. I believe we are at 3 years, is where we are right now, 2½ to 3 years. Let me make sure of that. Let me take that for the record to make sure I am exactly right. I don't want to guess here.

Mr. CULBERSON. Is there a mission being planned to Enceladus, to your knowledge?

Mr. LIGHTFOOT. Well, we would put out a new frontiers that would—that could be a proposed mission for sure in that.

Mr. CULBERSON. OK. Very good. Thank you.

Mr. Serrano.

Mr. SERRANO. Thank you, Mr. Chairman.

EARTH SCIENCE

NASA's Earth Science division works to develop a scientific understanding of the Earth and its responses to natural and human-induced changes. However, the President's budget proposal has a significant reduction in funding for external Earth Science research grants. Why is this being proposed? And shouldn't research grants aiming to study our own planet be made a particularly high priority?

Mr. LIGHTFOOT. Yes. What we have done with the Earth Science budget this year that we believe is the right way to approach it, we took kind of a risk management approach where we said what is the top science, what does the Decadal say, and then how are we doing from a performance perspective on the programs that are there?

Plus, we took into account that the next Earth Science Decadal comes out in 2017 that can actually give us some guidance to where we may need to go, because the last one was 2007. When we made the decisions we made within the budget we had, we had to balance all that.

We still have 20 operating missions, they are in space, plus we have a large airborne science campaign. We still have our STEM science activation program going on where we are funding folks at universities to help us with some of our challenges. We thought we have done the best balance we can within the budget we got.

Mr. SERRANO. OK. My concern is that if the grants are currently awarded at a higher rate of acceptance, isn't that a good thing? Although, talented researchers are and should be doing great work studying other planets and other solar systems, shouldn't we place a top priority on studying the changes happening in our own planet?

Mr. LIGHTFOOT. We are. I mean, we are still doing some of that work. That is what I am talking about with some of the STEM activation activities that we do in science. We will continue to do some of it. We won't be able to do it all. And that is what we did from——

Mr. SERRANO. And which other agencies do you work with on that?

Mr. LIGHTFOOT. Let's see, I believe we work with NSF and NOAA to do similar work in Earth Science. We are pretty complementary in the tasks there.

Mr. SERRANO. Within the CJS subcommittee's jurisdiction, both NOAA and the NASA Earth Science division are intimately involved in studying and tracking changes in Earth's climate. To your knowledge, did President Trump or his advisers consult with NASA's Earth Science division or rely in any way on NASA's Earth Science data prior to the President's announcement that he is pulling the United States out of the 196-nation Paris climate agreement?

Mr. LIGHTFOOT. They did not consult with us. I cannot say whether they used our data in terms of making that decision, but they did not consult with the Earth Science division.

Mr. SERRANO. And your data wouldn't have suggested they would pull out, I suspect.

Mr. LIGHTFOOT. There is a lot of data there, sir. I don't know if that would have done it or not.

ARECIBO TELESCOPE

Mr. SERRANO. OK. That is a good answer. That is a beautiful answer.

Administrator Lightfoot, you are aware of my interest in the Arecibo telescope in Puerto Rico, a 1,000-foot wide radio telescope used for radio astronomy, hemispheric science, and radar astronomy. Could you explain for our audience and for me some of the most important ways that NASA and the Nation continue to benefit from utilizing this telescope and others like it?

Mr. LIGHTFOOT. Yes. We use Arecibo—we use several instruments to track asteroids near asteroids, and Arecibo, we use that to characterize. Once we identify one, we use the Arecibo and Goldstone, for instance, is another one that we use to actually characterize the shape, you know, what kind of asteroid it could be.

We look at it—it is almost the radar and then the characterization kind of mentality that we use. Arecibo is an important part of that mission for us. We expect to spend roughly the same we have been spending there as we move out in the future. I think it is $3.6 million, what we use there today that we work with our friends at NSF, depending on where they go with it.

Mr. SERRANO. Very briefly as a followup. At yesterday's hearing, NSF was basically telling us that they are trying to get away from the Arecibo Observatory. They didn't say it in those words, but we know that that is the case. Is that the same case with your involvement?

Mr. LIGHTFOOT. I think the way we have looked at it is we will use it if it is there, because it is a capability that we can use, but we also have other assets that actually can help us as well from characterization of asteroids.

Mr. SERRANO. Thank you, Mr. Chairman.

Mr. CULBERSON. I want to join my good friend Mr. Serrano expressing my strong support to keep the Arecibo radio observatory open. It is a unique strategic asset to the country and a tremendous capability that we don't want to lose.

I am very pleased to recognize the gentleman from Kentucky, Mr. Rogers.

CHAIRMAN ROGERS OPENING REMARKS

Mr. ROGERS. Thank you, Mr. Chairman.

Welcome, Mr. Administrator. I have been a space nut since I was a teenager.

Mr. LIGHTFOOT. Me too.

Mr. ROGERS. In fact, when Sputnik went up in 1957, it was so exciting. I quit a job in a radio station in North Carolina and enrolled in physics at the University of Kentucky, aiming for Cape Canaveral. But the first year was, of course, all math, and I wanted to shoot rockets. I got bored with the math. I switched off to something else.

But NASA is more than a space-launching agency. NASA is an inspiration maker, a dream realizer. The space race with the Soviets and the race to the Moon energized, inspired, excited the world, but especially here at home. And all of the spinoffs that have been caused by the space program and so many different arenas has been absolutely phenomenal. We lack that excitement today.

I have no doubt, Mr. Chairman, that there probably would not have been a moonshot, but for the challenge of the space race with the Soviet Union at the time. I am not advocating anything like that, but we need—the country needs the inspiration that you and I both gained from early NASA activities.

What can you tell us about building the dreams and inspiring the country?

Mr. LIGHTFOOT. Well, I think that there is plenty of that right now. I will give you a great example just from yesterday. We selected 12—announced 12 new astronauts out of the record number of applicants. We had 18,000 people apply to be astronauts and we picked 12.

Two months ago, we discovered potential exoplanets, called TRAPPIST–1, roughly seven exoplanets. We had 4 billion hits in our social media for just understanding what is going on there.

I think that the missions we do still inspire. I think they still engage youngsters everywhere. I mean, my kids are sending me stuff that they see on Instagram and Facebook—which I am not on, right—asking me, Dad, what is going on here? This is pretty cool, right.

I think we still have a great presence, and I think that presence is related to the missions that we do. I think the missions, as long as we do, much like what the chairman said about when we—we are actually trying to make civilization-level impacts. We are trying to learn things that are going to change the way we look at everything. Those kind of missions really inspire everyone to pay attention to what we are doing.

I think it is still there, maybe not as much as it was when we, you know, walked on the Moon, but I tell you, I am pretty inspired by what we are doing, and our teams are very inspired by what we are doing. We don't have any trouble getting any workforce to help us do it.

Mr. ROGERS. Good. Good. I am glad to hear that.

The October moon, you remember the book and the movie——

Mr. LIGHTFOOT. Oh, October Sky? Rocket Boys. I think it is Rocket Boys, yes.

Mr. ROGERS. October Sky, yeah. I identified very, very much with that young kid, and I am sure you had somewhat of a similar excitement.

Mr. LIGHTFOOT. Oh, yes.

NASA EDUCATION

Mr. ROGERS. I am concerned about your proposed—in your budget, your cuts to the Office of Education, in fact, zero. That gets to this, what we are talking about. The education programs hopefully have been spreading the word about NASA's excitement and all of that. I can't understand why you would want to cut that. The EPSCoR and space grant programs. Two of my universities have used those moneys to start small but remarkably successful aerospace programs. Your investments have promoted high retention for Kentucky STEM workforce.

Just in April, you deployed two CubeSats developed by the University of Kentucky and Morehead State University as part of your ongoing educational launch of nano satellites mission. The first time two Kentucky satellites, by the way, have been ever launched simultaneously. Thank you very much.

What can you tell us about the education programs that are now zeroed down in your budget request?

Mr. LIGHTFOOT. Yes. What we did is—or what we have been doing for a while is doing an assessment around our outreach activities that we do and our education activities that we do and trying to better do—do those a little more effectively or efficiently from an Agency standpoint.

What we felt was that we still have several activities going on within each of our Mission Directorates, Science, Space Technology, Human Exploration, and Aeronautics that actually still do research fellowship programs with universities, still do STEM activation in the science community, and we felt we could balance those better. The decisions we made, we thought we could still do the outreach and do it a little more effectively going forward.

I don't deny that the programs have been pretty successful for us, but we felt like in the balance of things we could do this more effectively in a different way.

Mr. ROGERS. Well, you couldn't beat the kind of outreach that I experienced back last August, a year ago, where the students in Leslie County, mountain area—very remote—every student in that elementary school gathered in the gymnasium and hooked up with a——

Mr. LIGHTFOOT. International Space Station.

Mr. ROGERS [continuing]. International Space Station. And the astronauts did a fantastic job, by the way, for an hour. That will be in the minds of those young people from here on. And that is the kind of thing that I think we need to do more of, inspiring the up-and-comer young students who have no other way to understand and learn about what space is all about.

Mr. LIGHTFOOT. I completely agree, and we will continue to do down links from the International Space Station with schools.

Mr. ROGERS. You have got the only classroom there is in space.

Mr. LIGHTFOOT. I have also got a school of your kids over at NASA headquarters right now that are in town. One of the students reached out to me directly in an email and said they want to know more about NASA. It is one of the—from Kentucky. And I was supposed to do that, but you guys scheduled a hearing or I would have been talking to them right now.

Mr. ROGERS. Mr. Chairman, can he be excused?

Mr. CULBERSON. Anything for Kentucky.

Mr. ROGERS. Thank you.

Mr. LIGHTFOOT. No, they are very excited, though.

Mr. SERRANO. Two Kentucky launchings?

Mr. ROGERS. Yeah.

Mr. SERRANO. Not bad.

Mr. CULBERSON. Thank you, Mr. Rogers.

Mr. Kilmer.

Mr. KILMER. Thank you, Chairman.

And maybe, just to begin, I would like to echo the comments of Chairman Rogers. We had a NASA explorer school in my district, and I got to visit, and the kids were mesmerized. It was really amazing. Someone presented a slide that showed a giant hole on Mars. I joined every one of the children in walking out of that gymnasium, and calling my wife and saying, "did you know there is a giant hole on Mars and we don't know how deep it is?"—it was awesome. It was really cool, really inspiring.

I share the concern that defunding the education activities at NASA would jeopardize that sort of excitement.

Last Congress I worked with NASA to write and introduce a bipartisan bill called the United States and Israel Space Cooperation Act. It was recently reintroduced, and it seeks to recognize and strengthen our longstanding and mutually beneficial partnership with Israel on peaceful exploration of space.

Do you see opportunities for NASA to partner with the Israel Space Agency? And can you give us a sense of what efforts are currently underway in that regard?

Mr. LIGHTFOOT. Yes. We already participate with them with our GLOBE program, aeronaut program. These are things that they participate with us on. We also see some opportunity maybe in the SmallSat/CubeSat arena that we will be looking at, and we continue to have the dialogue with them today.

I would leave the aperture pretty open and see what—what we find when we work with any of our international partners, because we work with so many, is they have niche areas they are interested in. Oftentimes, they can fill the areas that—they can fill spots for us in doing those things. I think we will continue to work with Israelis just like we have already.

Mr. KILMER. Is it correct that during NASA's Exploration Mission-1, they will be testing a radiation vest from StemRad, which is an Israeli company?

Mr. LIGHTFOOT. I know at one time that was in the planning. Can I get back to you for the record on that?

Mr. KILMER. Yeah.

Mr. LIGHTFOOT. I definitely know it was——

Mr. KILMER. I know that there is some interest in it because it helps kind of get a sense of the effects of deep-space radiation.

IN-SITU RESOURCE UTILIZATION

Mr. LIGHTFOOT. Yes, sir.

Mr. KILMER. I also want to ask about just the cost of access to space. As you know, it currently costs $15.6 million per metric ton to get to geostationary orbit with a maximum payload. If, however, you refueled a rocket in low Earth orbit en route to geostation orbit, the price drops to $12.5 million, and the payload can increase more than twofold. Even better savings can be realized if we utilize on-orbit refueling for both Moon and Mars missions.

So there has been, I think, increasing interest in using asteroids as a launching pad for that. They have the capacity to unlock the solar system's economy. Can you give us a sense of where asteroid resource utilization is in NASA's exploration roadmap?

Mr. LIGHTFOOT. Well, of course, in this proposal we canceled the asteroid redirect mission where we were going to bring one back. For us, what we are trying to do is understand how we can use any resource of any body, not just asteroids, how can you do it. We call it in-situ resource utilization, where we can utilize the stuff that is there when we get there as opposed to bringing it with us.

That is where we are today. I know there is quite a bit of interest in the commercial arena. We had several companies come talk to us about doing mining, say, on the Moon.

Mr. KILMER. Sure.

Mr. LIGHTFOOT. To me, that is a great—from my perspective, that is a great example of a public-private partnership where some-body in the private industry has an idea and we can help enable them, as we have done with some of the other things we are doing.

Mr. KILMER. Last week—and this has come up in a number of our subcommittees. Last week, Politico had an article that said the White House has been telling agencies not to respond to questions from Congress if those questions came directly from Democratic members. For example, at a hearing in May, the acting administrator of the GSA said, quote, "The administration has instituted a new policy that matters of oversight need be requested by the committee chair."

To your knowledge, has either the White House or the Office of Management and Budget approached NASA about implementing that type of policy that would prohibit answering questions from Democrats?

Mr. LIGHTFOOT. No. No.

Mr. KILMER. Good. Thank you. I am pleased to hear that.

Do I have a little more time? Let me ask just quickly. We have heard a lot about NASA's desire to enable the commercial space industry by, first, focusing on the commercialization of low Earth orbit. The commercial space industry has said it is important to know NASA's low Earth orbit requirements to help with their planning for future commercial space station capabilities.

Can you talk about how NASA is working with the commercial space industry to communicate your residual low Earth orbit requirements to industry?

Mr. LIGHTFOOT. Yes. There is numerous ways we are doing that. We are looking at the technologies we need to develop for us to move onto deep space. We are looking at what would be required from a health and human perspective for crews. We have a plan on the International Space Station today to retire those risks, right. If we don't, you know, there is going to be things that we aren't going to completely retire. As we don't finish those things as we move on out, we are going to need people to actually be there to help us to retire—continue to work on those risks going forward.

We have a good list. We provide it in different ways: through broad area announcements, through RFIs that we put out for people to say is anyone interested or working on a technology they could do this for us. That is the way we usually do it, from that perspective.

Mr. KILMER. Terrific.

Thank you, Mr. Chairman. I yield back.

Mr. CULBERSON. Thank you very much, Mr. Kilmer.

I recognize Mr. Palazzo.

CONGRESSMAN PALAZZO OPENING REMARKS

Mr. PALAZZO. Thank you, Mr. Chairman.

Mr. Lightfoot, you talked about accelerating the SLS to include a manned EM–1 mission. The feasibility report last month said it was technically possible to do so, but NASA decided against it now that SLS and Orion budgets are down and the timeline has slipped to 2019. That leads to my question: Can you walk me through both the decision not to pursue a manned EM–1 mission and the delay to 2019?

Mr. LIGHTFOOT. Yes, sir. Let's start with the EM–1 crew decision first, if that is OK. We asked for the feasibility of this. We asked several teams to get together and decide what happened. Of course, we have been doing this for a while not expecting to put crew on EM–1. The first thing we had to do is go back for like 3 years and say what decisions have we made that you need to reopen now that we are going to put crew on there, from a risk perspective, a technical risk perspective.

We did the technical risk assessment, we did a schedule risk assessment, and then we did a cost risk assessment when we went through it. It came out that it was feasible. I mean, we could absolutely do this, but what it cost us was it was going to cost us more, it was going to push the schedule out, and then there we were going to accept more technical risk.

Really what it kind of did for the most part is it validated our original plan, which is we need to do this test flight. However, in the process of doing that, we found two or three pretty critical areas that we need to do some more work on.

The heat shield on Orion, there was some questions about some of the things we wanted to do there. There were some questions around some of the systems in the European service module, and we wanted to make sure we understood those better before we flew the first mission, even if crewed or uncrewed. Then there is an ascent abort test we were going to do after EM–1 that I think we are going to pull forward now, because we think it is important to go ahead and get that done.

The study itself was really good in identifying some of the critical things.

As far as the date for EM–1, crewed or uncrewed, the first date for the uncrewed mission, when the tornado came through Michoud, we were already dealing with some weld issues. We were trying to do a weld on a tank that we haven't done before, and that is just kind of a technical challenge for us that we are working through. The tornado came through. We lost access to the area where we are, or where we were doing the welding, for about, ah, depending on how you look at it, it cost us 1 or 2 months, probably a little more, actually, when it is all said and done, and we are struggling with this weld.

The move of the date was more related to the fact that we are having the technical challenges with this weld schedule that we have got to go do. I think that is probably the best summary. I hope I got that for you, sir.

SPACE LAUNCH SYSTEM STATUS

Mr. PALAZZO. That works well. And so going back to the tornados that went through Michoud, and because the majority of the SLS components are manufactured there, including the welding, you said—I think you just said it might be a 1- to 2-month delay. Is that all you see from the damage that happened at Michoud or could there be more slippage?

Mr. LIGHTFOOT. Yes. We are looking at that now, right. We owe a report back probably next week, I think, is when we are having the meeting.

The tornado was part of it. The weld schedule is another part of it, and we are trying to assess where that is. The tornado wasn't the only thing. It was the weld and the tornado coming through.

Mr. PALAZZO. All right. Apollo 17 was known as the last moonshot, and it put three astronauts on the Moon. It launched December 7, 1972, almost 45 years ago.

There are a lot of discussions over the past few years about a decimation in getting back to deep space. And the President has even talked about trying to get a man to Mars in the 2020s. Can we do this? And what will it take to get a man back on the Moon and eventually to Mars?

Mr. LIGHTFOOT. My current plan right now is we are looking at roughly—when we look at a horizon goal of getting to Mars, we look at 2033 as being a good opportunity. There are certain windows that are better for getting to Mars than others. We are looking at 2033.

The way we are doing this is we are using the International Space Station today as our jumping off point where we can get all the technologies developed, understand everything that is happening to the human body, right, and then, frankly, enabling a commercial industry. We give them a destination and we give them the opportunity to get their systems down.

We will slowly progress out, take a stepping stone process to get us out and around the Moon to test further systems that we are going to need. It won't be as big as we have in low Earth orbit, but there will be systems that we can actually use. Think about a backbone or an infrastructure that we can then use. From there, we will test those systems for longer duration, because we need to be good for 2 to 3 years when we talk about going to Mars. Test those systems out and then move toward going out to the next step to Mars.

We look at the decade of the 2020s as kind of our time to prove all that out in the—get those systems ready to go so that we can then go in 2033 to Mars. It is kind of a stepping-stone approach, right, that we have. We don't assume any—we pretty much assume the current services that we have budgetwise today with an increase in inflation as we go forward. That is what we assume when we are making these plans. I think that is kind of a methodical approach that we take, a systems approach to getting there, and I think it is the right way to do it.

Mr. PALAZZO. Well, I appreciate that response.

And I would like just to mention that I do think it is important to be focusing on planetary sciences and looking out. There is already over a dozen Federal agencies that study our Earth, but there is only one agency tasked with space exploration, and that is NASA. And with limited funds, flat funding, and budgets, I think our resources are better spent, you know, exploring the deep space and not focused on what other agencies are already doing.

Mr. LIGHTFOOT. I understand. One thing, just for consideration, there is a lot of analog to learning about Earth and how it plays with the other planets, because Earth is a planet as well. How Earth evolves, we learn a lot from learning about Earth on what could happen to Mars and what could happen to Venus. There is a value for us in learning about Earth as well. I understand your point.

Mr. CULBERSON. Thank you very much, Mr. Palazzo.

I would like to recognize the gentlewoman from New York, Ms. Meng.

CONGRESSWOMAN MENG OPENING REMARKS

Ms. MENG. Thank you, Mr. Chairman.

And thank you to Mr. Administrator for being here today and for all this very interesting work. As a new member of the committee, I am learning a lot.

I want to, first, thank you and NASA for conducting so much important research on the commercial air transportation system and flight noise situations. And I just wanted to get your take on why research of excessive flight noise and noise mitigation is important to NASA and to our country.

Mr. LIGHTFOOT. Yes. Well, clearly, aviation travel has become a big deal now. I mean, it has gotten routine for those of us that travel a lot, and we like to say NASA is with you when you fly. There is a lot of systems on every airplane and in every airport that we have worked with our partners in the FAA to develop over time.

Noise mitigation is a clear one, right, when you have so many people moving in closer and closer to airports. We have what is called technical challenges in our aeronautics area that work on aviation safety. They work on the environmental responsive activities that we do, whether it is cleaner fuel or whatever it is that we use for aircraft, but they also do noise abatement as well.

All of those are critical to us in terms of making sure that our aviation industry is a good neighbor for everyone, what they are dealing with, but also still being reactive to what we need as customers in that arena as well. That is what we think our role is.

AIRCRAFT NOISE MITIGATION

Ms. MENG. For noise mitigation, from an environmental perspective or a safety perspective, why is noise mitigation important?

Mr. LIGHTFOOT. I think—well, noise mitigation is really the good neighbor, right. I mean, if you think about environmental, environmental is not just biofuels and things like that. It is also the noise pollution, right. Our job is, again, as things move closer and closer around airports, you have got to be a good neighbor.

I think that is some of the stuff we are trying to do to decrease the noise levels and help set those better.

Ms. MENG. Do you think there is more that the Federal Government can do, whether it is NASA or other agencies, to combat this issue of noise mitigation? My district is in between the two airports, LaGuardia and JFK in Queens, New York. New York is considered to be the busiest and most complex air space in the country.

Currently, NASA invests in aircraft technology such as the X-Plane and air traffic management and operations, which would limit the effect of noise and amount of time planes are spent hovering low over neighborhoods. What are you doing in the coming year to address airplane noise?

Mr. LIGHTFOOT. Well, like I say, we have a program and several activities in place. What I would like to do, if it is OK, is get my team up here and let them bring you exactly what we are doing in that arena. I think that would be better than me trying to try to pull it off the top of my head. If I could do that, I think you would find it fascinating what the teams are trying to do.

Ms. MENG. And do you have any suggestions if other agencies could do more to be helpful in this area?

Mr. LIGHTFOOT. I am just not familiar enough to know. I mean, we work with FAA on these things quite often, obviously. They are a partner for us. When the teams come up, we will make sure they bring that forward if that is OK.

Ms. MENG. OK. Thank you.

Another question. The amount of manmade debris orbiting Earth grows every year disrupting our satellites and putting astronauts in harm's way. If current trends in space junk continue, low Earth orbit could become unusable for our future satellites and missions. We heavily depend on the communication capabilities provided by these satellites, and I am concerned about the economic impact of future space debris collisions and what that would mean for our communications infrastructure.

What is NASA currently doing to mitigate space debris? And are there plans to actually remove debris? And how is NASA planning to increase these activities moving forward?

Mr. LIGHTFOOT. Right now, in—I will take that in pieces. Today when we launch, we have requirements that will make us de-orbit things, like the second stages of rockets. We have to carry enough fuel to be able to de-orbit so they don't stay up there. That is one thing that we do, and everybody has to do that.

We didn't do that back in the 1970s and the 1960s, so there is a lot of stuff still up there. The only thing we are doing inside NASA is we are working on technologies, very small amount. I don't want to imply that there is a big amount here, but it is a very small amount on technology and studies around what you could do.

We haven't had the charter to go do that. I am not sure that is our charter necessarily, but we know it is a risk. We all understand it is a risk going forward. So far, that is what we have been doing as far as orbited debris goes.

Ms. MENG. Thank you. I yield back.

Mr. CULBERSON. Thank you very much.

I will recognize the gentleman from West Virginia, Mr. Jenkins.

CONGRESSMAN JENKINS OPENING REMARKS

Mr. JENKINS. Thank you, Mr. Chairman.

Administrator, thank you for being here.

Chairman Rogers referenced Rocket Boys and October Sky. I am proud to be the Congressman from the Third Congressional District, and talked to Homer Hickam just a couple of weeks ago. He is doing well, and we are certainly very proud of that kind of ingenuity and spirit from our State.

NASA EDUCATION

Also similar to Congressman Rogers, talking about the education, you know, we are not Florida. We are not Texas, but NASA has a real impact. And I know we have some of the brightest minds that, when given the chance to compete, they win. Look at the centennial challenge. You are nodding. I appreciate it. You know where I am going with this.

Our WVU students in 2014 won the level one challenge. For those who aren't familiar, this is where NASA has challenged the citizens, the public, to say help us, NASA, solve big problems and issues. And you put out the marker making it a competition, and West Virginians stepped up to the plate in 2014. WVU students won level one. And in 2015, 2016, the only team to have won a level two twice.

So whether it be Homer Heckam from Rocket Boys to WVU students winning national competitions, there is a lot of exciting things and capabilities and talents from West Virginians.

I want to go back to your opening statement where you talk about consistency of purpose. You identified the three areas of influence and your mission statements. And then, again, Chairman Rogers raised the issue about the same concerns I have, the defunding, the elimination of the Office of Education, the EPSCoR programs, things that are so important to a State like West Virginia that doesn't have the big NASA assets but is doing good work in support of NASA.

In one of your previous answers, you said, well, we are doing this to, quote, be more efficient in a different way. And I would like for you to explain for me a little more about how you were taking these programs that are proving very successful in my State, and are you able to reassure me that while, yes, we are zeroing out here, we can reassure you that we are going to be efficient and effective but just in a different way, and you will continue to have that level of support.

I want to understand what being more effective in a different way really means and how that impacts the programs that mean so much in West Virginia.

Mr. LIGHTFOOT. Yes. I think the way we look at it in the Agency is, what we found is that we have an education program, right. We have outreach that a lot of the mission support—or missions do on their own. How can we sync those together so that they actually get—we get an economy of scale between the two instead of them being stovepiped?

In the example you used with WVU, that actually is not an education program, that was actually in our Space Technology Mission Directorate. We are looking at the centennial challenges there, right, where the guys were working there. We are looking at where we can use our missions more instead of a stovepiped education thing so that we can leverage what we need in our missions and get, just like you said, get the kids engaged in solving those solutions for us.

We really—we started this long before the budget discussion as part of our baseline services activity we have been doing, not just in education and outreach, but in procurement and human capital and other areas to say, how can we leverage our things better and run the agency a little more efficiently?

That is what I mean by effective and efficient. If we can start connecting the dots between what the missions need and the money they are already spending and engage using some of the way we think about engaging the educational institutions so we can go forward.

Space technology has their—they have a research fellowship that is still in there. We have the STEM science activation program that science does still, those kind of activities, and then there is a university innovation and challenges activity that is in aeronautics. So we are using our missions to fund those kind of things to engage the workforce.

Mr. JENKINS. Well, 10, 15 years ago, I served on the EPSCoR advisory board. So are you—I want to try to cut to the chase, are you telling me that the EPSCoR funding or similar funding will still be there but from a different source or are you cutting out that funding and just going to be doing other things in other areas that are more efficient?

My direct question is, will EPSCoR funding be there in some form or fashion and the other kind of education resources that have been provided?

Mr. LIGHTFOOT. Yes. We have proposed no EPSCoR space grant from your end. There is nothing proposed there. We are going to see how can we get similar results in a different way. It is definitely not in there.

Mr. JENKINS. Well, I will be going to bat because I do believe EPSCoR has been very effective. That is how we are able to compete, these students. So I appreciate your directness and, again, look forward to working with the chair and the committee to try to advance the priorities that I think are important from a funding standpoint.

Thank you, Mr. Chairman. I yield back.

Mr. CULBERSON. You bet. Thank you, Mr. Jenkins.

I will recognize the gentleman from Pennsylvania, Mr. Cartwright.

CONGRESSMAN CARTWRIGHT OPENING REMARKS

Mr. CARTWRIGHT. Thank you, Chairman Culberson and Ranking Member Serrano.

Mr. Lightfoot, thank you for being here this afternoon.

I am particularly concerned about the proposed cuts to NASA's climate science programs. The administration has expressed the view that NASA should be focused on outer space and leave the job of observing Earth to other agencies. But NASA's unparalleled experience and expertise in developing new observational technologies and launching satellites makes it a crucial part of the Earth Science enterprise. NASA's wealth of engineering expertise is virtually impossible to replicate in other agencies.

NASA EARTH SCIENCE

Now, while NASA's fiscal year 2018 overall budget proposes only a 0.8 percent cut, it proposes reducing funding for Earth Science by as much as 9 percent. Now, to achieve this 9 percent reduction, which is hugely out of line with the cuts and the other part of the budget for NASA, to achieve this, funding for five Earth-observing missions is completely eliminated. These missions would plug crucial gaps in our understanding of Earth's complex climate and how it is changing.

The first question I have for you is about OCO–3. The budget terminates Orbiting Carbon Observatory 3, OCO–3, which measures carbon dioxides from space. The administration's budget justification explains that OCO–2 is already measuring what we need, but this isn't quite the case.

OCO–3 improves on at least two OCO–2 limitations. It would be able to measure carbon fluxes at different times of the day and it could pinpoint specific locations on Earth to, for example, measure emissions from different cities, land versus ocean ecosystems, and detect signs for drought stress in crops before such signs become visible to the naked eye. These are things that the OCO–2 cannot do.

Is it the administration's belief that we don't need to know where carbon emissions are coming from? Is there some other way to get that data that OCO–3 would provide?

Mr. LIGHTFOOT. Well, for OCO–3 in particular, what we did is we—I think I said, and you may not have been here. What we did is we did kind of a systems engineering approach to all the Earth Science missions and said where can we get the data that is there, and which ones from a standpoint of the science, as defined in the Decadals, the performance of their—the current performance in terms of how they are performing to get ready to fly, were the way we looked at this, and then where can we get the data from somewhere else, even if it is not at the resolution that folks want, from a risk perspective, right.

That is how we made the decisions that we made with CLARREO Pathfinder, OCO–3, RBI, and PACE. I mean, that is the way we step through it trying to balance the entire portfolio. We still have 20 operating missions. We still have an airborne science campaign. We still believe we are spending $1.7 billion on Earth Science and have a pretty good portfolio to allow us to understand what is happening here.

Mr. CARTWRIGHT. All right. Next question. The budget proposes elimination of the Climate Absolute Radiance and Refractivity Observatory, CLARREO, CLARREO Pathfinder, an instrument designed to improve a source of uncertainty in climate science, one that comes from Earth-observing instruments themselves. CLARREO offers scientists the data they need to produce highly accurate climate records as well as refine and test climate projections, the kind of projections that might inform decisions on how to respond to rising sea levels, rising global temperatures, declining air quality.

CLARREO was identified as a high-priority NASA mission in the previous Earth Science decadal survey. NASA has labeled the CLARREO Pathfinder mission a risk-reduction mission. How does its elimination affect the goals of CLARREO and CLARREO's future launch? And does NASA plan to continue the CLARREO program in general?

Mr. LIGHTFOOT. When we did CLARREO Pathfinder—the reason we didn't do CLARREO to start with is because it was a very expensive mission, potentially over a billion-dollar mission. What we want to do is use Pathfinder, which we can put on the International Space Station, utilize the International Space Station, to do risk reduction toward the bigger mission down the road.

With a new decadal coming out this year, in 2017, we cancelled Pathfinder to see how CLARREO actually ranked in this next decadal before we actually talk about spending that kind of money going forward. That is why we have cancelled Pathfinder, to see what the decadal says coming back.

Mr. CARTWRIGHT. I thank you, Mr. Lightfoot.

And I yield back, Mr. Chairman.

Mr. CULBERSON. Thank you very much, Mr. Cartwright.

I recognize the gentlelady from Alabama, Mrs. Roby.

CONGRESSWOMAN ROBY OPENING REMARKS

Mrs. ROBY. Thank you, Chairman.

Thank you, Administrator, for being here today.

Great nations dare greatly, and the exploration of space is an unlimited challenge but one that the United States dared to pursue and an area where we have led from the 1960's into this new century. Recently our resolve to lead in the exploration of space has faltered. And I am very hopeful in this Congress, and this new administration, that we have a chance to regain the initiative and reaffirm our leadership into space.

And I share concerns that my colleagues have already shared with you. But I know with your background and in your current position, you obviously understand the important role that Marshall Space Flight Center, located in Huntsville, plays in NASA's vision in testing and operations into deep space. You have already talked somewhat at length about SLS and the missions even into the outyears, so we won't go over that again.

NUCLEAR THERMAL PROPULSION

I do, however, want to talk about NASA's plan for nuclear thermal propulsion technology. If you could just kind of go over the scope, the schedule, and the cost of the initial test for this on the ground, that would be very helpful.

Mr. LIGHTFOOT. What we are trying to do is do some of the early technology risk reduction in nuclear thermal propulsion. A lot of that has got to do with materials. We have got some work that we were doing in 2017, in the 2017 budget, I think 35 million in space technology to work on different options to get us to kind of, I don't want to say a down select, that is a little strong, but to get us to see which path we need to take, because the next step is going to be a pretty big one for nuclear thermal propulsion.

We think nuclear thermal propulsion gives us an option to reduce the transit time. I mean, that is the value proposition of that so that we can keep crews—we can get crews to and from quicker from the radiation perspective. It also gives us some other advantages on some deeper space probes that we could use, some early looks at doing things faster.

Right now, it is really just a technology development program trying to knock down some of the what I would call the risks associated with materials going into that.

Mrs. ROBY. There are no specific target dates or a timeline?

Mr. LIGHTFOOT. Not yet. Not until we understand the—not until we get a feel if the technology can actually be done, because I don't really want to put a date out there if we don't know what is in front of us yet.

Mrs. ROBY. Sure. I understand. Just please keep us posted.

Mr. LIGHTFOOT. Oh, yes.

ADDITIVE MANUFACTURING

Mrs. ROBY. My next question is about the additive manufacturing on rocket propulsion. And in the fiscal year 2017 Consolidated Appropriations Act, enacted just a few weeks ago, Congress provided 25 million in funding to continue additive manufacturing efforts. So what is the plan for this appropriation? Does NASA intend to allocate the entire 25 million Congress appropriated for this project? If not, why? And maybe talk a little bit about what NASA centers are involved and what roles they are playing here.

Mr. LIGHTFOOT. Additive manufacturing is a game changer for everybody. It is an interesting way to manufacture. From a propulsion perspective, we think there is a big advantage in engine parts and simpler engine designs. Some of our commercial folks are doing this already and proving that it works pretty well.

We are looking at a lot of the material properties that come with additive manufacturing going forward. We know it is in the 2017 appropriations direction. You will see that when the operating plan comes up. Going forward, we intend to spend the 25 million on that. That is our plan right now.

Mrs. ROBY. Well, it is absolutely fascinating to see, and like you said, a huge step.

So with the risk of knowing that this might upset half of my constituency, I would be remiss if I did not tell you, "Roll Tide." We are very proud of you, and all the time that you have spent in Alabama, and congratulate you on this role, and look forward to working with you down the road. So thank you, again, for being here, and thank you, Mr. Chairman.

Mr. LIGHTFOOT. Thank you.

Mr. CULBERSON. Thank you, Mrs. Roby.

It is my pleasure to introduce the gentleman from Alabama, Mr. Aderholt.

CONGRESSMAN ADERHOLT OPENING REMARKS

Mr. ADERHOLT. Thank you, Mr. Chairman.

Administrator, welcome. Good to have you here today. And thank you for your many years of service to this country as an employee and manager at NASA. I have enjoyed having a chance to work with you over the last several years.

Of course, NASA is an Agency whose budget has been constrained for many decades, especially when you compare it to a lot of other agencies here in Washington. So your accomplishments and your service are certainly much appreciated.

Americans and really, I think, the entire world are very interested in your Agency and it is impossible to cover all the topics in one hearing, but I do want to touch base on just a couple of things, and I want to follow up with one of the issues that we just were referring to.

Some Members, such as myself, voted for the NASA authorization bill in 2010 with the understanding that SLS and Orion would be supported by the administration with a launch date of late 2017 or early 2018. That support turned out to be tepid with a low budget request.

That bill also included an administration priority, the creation of a new space technology account. It is not easy for Congress to shoehorn a new account of over $500 million into a tight top-line budget.

Solar electric propulsion has been robustly funded and holds promise of prepositioning supplies as part of a deep space mission. Its slow speed, however, makes it too slow to consider for human transport to Mars, as it was noted in the Augustine Commission.

NUCLEAR THERMAL PROPULSION ACTIVITIES

As we have just noted here with my colleague from Alabama, nuclear thermal propulsion could be added to our family of propulsion systems to provide a shorter and safer journey to Mars for human mission and it would make more time available on mission once the astronauts arrive. Congress directed 35 million to be spent on nuclear thermal propulsion in the fiscal year 2017 bill.

My question, does NASA have a plan yet for focusing on those contracts, on work related to propulsion, or are the funds being broken up and used for nuclear work not related to propulsion?

Mr. LIGHTFOOT. I think we have a plan. I can't speak at the level of detail for the contracts. I would have to bring you that information. I would probably need to bring it to you for 2017. I know we are building out a plan now where the 35 million is actually all being spent and how we are actually deploying it out. If it is OK, I would like to take that for the record.

Mr. ADERHOLT. Yeah, please.

But you see where I am going with this and how we might could try to address that.

Mr. LIGHTFOOT. Yes.

NASA CONTRACTING

Mr. ADERHOLT. The other thing is I just want to mention contracting philosophy. There is no type of contract that is perfect, as you well know, and the FAR contracts have received a lot of blame for past problems. After all, it is my understanding it is possible to put penalties into contracts. FAR contracts offer opportunities to audit work and to know where the taxpayer dollars are actually spent. They offer the opportunity for companies to lodge a complaint with the GAO if competition criteria were changed midstream.

OTA contracts do not offer the taxpayer the same protections. When a company has already developed its hardware with its own money and has a healthy business model, even without government contracts, OTA agreements can be helpful. Although the commercial cargo and commercial crew programs were presented by the previous administration as merely purchasing services, in reality the taxpayer is paying 80 percent or more to develop hardware for the big ticket projects.

Moreover, to assume that a FAR contract would be more expensive is essentially a straw man argument. When a company proposes to take astronauts to the International Space Station for $20 million a seat, and then in 2017 the estimate is almost $60 million a seat, the question is, why is the estimate 300 percent off the real price?

If NASA were any kind of business, someone would certainly be held accountable for a big cost estimate mistake, especially when that first price is used as a reason for abandoning a FAR contract and a transparent competition process.

We need a more vigorous assessment of commercial launch programs which compare the promises to the results, not a comparison with the unsupported assumption that a FAR contract would have been more expensive.

Let me say, I think that public-private partnerships are good when the private investment is openly reported and when the taxpayer is protected by realtime penalties instead of possible discounts for a service that will be in the future.

So I just wanted to ask you, would you be open to creating more transparency and more reporting in regard to contracts overall?

Mr. LIGHTFOOT. I think, for us, we use the entire spectrum of our acquisition strategy process. I mean, we have several mechanisms we can use, several vehicles, including things in the NASA FAR supplement.

We are learning how to do this public-private partnership as well, right, and the kind of things that we need to learn. I think what I would commit is we are going to learn from these and we are going to make sure we are doing the right thing for the taxpayer on anything we do in the future. I think there is an advantage with public-private partnerships for us to get services and even products in a different way.

What we do—or what I do, I actually chair most of these discussions—is the acquisition strategy meetings where we actually decide what kind of mechanism are we going to use, and every time we bring in the lessons learned from the last time to make sure we are doing the right thing. That is what I will commit to you, that we use the lessons learned.

Mr. ADERHOLT. Well, let me say, again, public-private partnerships are good when the private investment is openly reported. And I think that at the bottom line we want to protect the taxpayer.

So thank you very much.

I yield back.

Mr. CULBERSON. Thank you, Mr. Aderholt.

Mr. Administrator, NASA yesterday announced the newest astronaut candidate class of 12 highly qualified individuals, as you said, from over 18,300 applicants. We congratulate them and I know everyone on the subcommittee joins me in saying how pleased and excited we are to be able to support them in the years ahead as they engage in one of the greatest of human adventures.

HUMAN EXPLORATION BEYOND LOW-EARTH ORBIT

Given that NASA continues to recruit and train new astronauts, would you please describe the Deep Space Gateway concept which sets a goal for human space exploration beyond low-Earth orbit and which could support multiple missions in cislunar space on the path towards eventually sending humans to Mars?

Mr. LIGHTFOOT. Yes. What we have been looking at is what is the infrastructure we need, the kind of backbone for doing this human exploration that we want to go do. We, at very much a conceptual level, we started talking about the systems we are going to need in cislunar space, around the Moon basically, that we can then use to either do work at the Moon or use to progress our missions out further into space, Mars, wherever we want to go.

So a simplified version of that is, can we set up really three pieces, a habitat, a power propulsion module, and an air lock, right, is really the kind of the core of this thing. Imagine this as a node that is out there around the Moon. You can go there. You can dock. You can do telerobotic operations in the Moon. You can move this around using solar electric propulsion that we had from the ARM or move this gateway around. You can also connect there with whatever you are going to take, the vehicle you are going to go to Mars in, and you can use that as the node where you leave from there to go out.

We think it is a good structure. It offers a lot of opportunities for our international partners to engage with things they may want to do at the Moon, but also to help us with what we need to do. It offers opportunities for private industry. We have a lot of folks that have come to us and talked to us about how they could utilize going to the Moon and use this as an opportunity.

We are excited because of the Space Launch System, the advantage to the Space Launch System, and what it does. We can actually carry the crew and the pieces in the trunk of the Space Launch System because of its lift capability. If we need to do anything, we will have the crew there with it when we are deploying those things out in cislunar space.

We really think that it really opens things up for us in terms of taking those next steps. What we have done, from a planning perspective, at a really high level, and we are still working with the administration on this, is we put in kind of what each exploration mission with the SLS and Orion would do, and which part it would take, and how we would put that in place in the decade of the 2020's.

So that is kind of our notional plan at a conceptual level. We think it really does—it is done within the current resources we have, considering escalation. We didn't assume anything extra. That is just kind of how we put it together. That is what we are trying to do from a human exploration perspective.

Mr. CULBERSON. So the first launch of the first piece of this would be approximately when?

Mr. LIGHTFOOT. Well, right now we are notionally saying EM2. When we take the first crew, we would like to take the power propulsion module in the trunk when we go.

Mr. CULBERSON. That is terrific.

This power propulsion module would essentially be like a solar electric propulsion system?

Mr. LIGHTFOOT. It would build right off the bus that we had for the Asteroid Redirect Mission.

Mr. CULBERSON. Right.

Mr. LIGHTFOOT. It would build off that bus. We would probably make it smaller than we were going to have for Asteroid Redirect Mission. The smaller part is actually good for us because it is more commercially viable for other uses of a solar electric propulsion bus. The one we were using for the Asteroid Redirect Mission was a little larger than anybody would really need for GEO or anywhere else that they want to go do.

I think the advantage is that it kind of gives us—it puts us in kind of a leadership role in cislunar where people can come work with us going forward.

Mr. CULBERSON. In essence, you would be assembling a smaller version of the space station in polar orbit around the Moon?

Mr. LIGHTFOOT. We would be able to move it where we wanted to move it.

Mr. CULBERSON. Because it is solar electric propulsion. But it would be a smaller version of the space station?

Mr. LIGHTFOOT. A lot smaller.

Mr. CULBERSON. A lot smaller.

Mr. LIGHTFOOT. Yes. Again, just kind of a stopping point, not really a place to stay. It would be human tended and not be there the full time with folks, but people could use it.

Mr. CULBERSON. Couldn't you also use it for returning samples from deep space, from the asteroid Bennu or from, for example, Mars 2020, it could be used to stage samples returning to Earth?

Mr. LIGHTFOOT. That is what we think, and then you basically have a system that gets you from Moon to Earth, and you have one that can go anywhere, and it becomes the hub that you go back to.

MARS 2020

Mr. CULBERSON. Talk to us, if you could, a little bit about Mars 2020. This was one of the top recommendations of the Planetary Decadal Survey. How is Mars 2020 mission progressing? Are there any concerns with meeting the 2020 launch date? And what are the plans for collecting and returning to Earth samples collected on Mars 2020?

Mr. LIGHTFOOT. The teams are doing great. We have had several reviews on it. We look like we are performing. The heritage system, the ones we basically brought from the current Curiosity rover that is on Mars now, they are being put together pretty well. The instruments are having what I would call typical challenges as they go through there. We did critical design review here recently, I got an outbrief on that, and things are going well. I think we are on track for 2020. It looks good.

Mr. CULBERSON. For 2020 launch?

Mr. LIGHTFOOT. Yes.

Mr. CULBERSON. Terrific. Thank you very much.

Mr. Serrano.

FUTURE OF NASA

Mr. SERRANO. Thank you, Mr. Chairman.

You are on the track that I was going to lead you into already. Some of the members have asked the chairman has asked a lot of questions. And that is, basically, what do you see as the future of NASA?

The reason for that is, there was an excitement, and I think it is missing from the public. And it might be related to manned travel, or, you know, man/female travel. As long as humans are on the ship, then it makes for excitement. When they are not, then it doesn't make for excitement. But at one time that is all you spoke about. And now you have Members of Congress opposing the NASA budget. In fact, I don't want to get partisan, but Vice President Pence, when he was here in the House, proposed getting rid of the Moon/Mars program.

So what do you see as the future of NASA? Or does NASA have a public relations problem that there is more going on than the public knows?

Mr. LIGHTFOOT. Well, I will probably leave the public relations part out. I am not a public relations expert.

Here is what I see the future of NASA. I think our job is pretty fundamental. We do advanced research, we lead discovery, and we gain new knowledge for this Nation and, frankly, for the world. Part of that is extending humans further into space. Part of it is the scientific discoveries we make, and I think that is just advancing human knowledge. That is what we do. Now, that may not be enough to excite people, but I think it is incredible what we do.

The other pieces that come with that is, I believe NASA has a role in the economic development of this country, and what we do for the industrial base, that is shared by so many other folks in terms of the advances we make and where we go. I believe we are, frankly, a strong part of our foreign policy with our global engagement and diplomacy. If you look at what the International Space Station has done and where we are there, it is another piece that we do going forward.

Our discoveries will continue to inspire. Whether they are human or scientific, they continue to inspire. I actually don't agree that we are not inspiring people. I think we still do just because of the people that follow us and pay attention to what we are doing.

I think that is what we will continue to do. We will continue to make the civilization-level discoveries that we do. That is why we are here. I can't predict them. I can only know that we are sending the right missions based on what we are told by our advisers in the national academies on the science side, based on our advisers in aeronautics, we are doing the kind of game-changing aeronautics we need to do.

From a human perspective, it is just written in our DNA to explore. I think as long as we are exploring—I mean, we have been on the space station for 16 straight years. That ship is tended. There are humans there. Peggy Whitson just passed the record for the longest amount of time in space. She is an amazing lady. I just think we will continue that. She inspires folks every day, is what she is doing.

Mr. SERRANO. How many years, you said?

Mr. LIGHTFOOT. We have had a continuous crew for 16 years on the International Space Station. Not the same person. Every six months we rotate. For 16 years there have been people on the International Space Station.

Mr. SERRANO. That is incredible.

Mr. LIGHTFOOT. One of the things I like to say is if your kid just got their driver's license—most kids get them at 16—there has always been someone in space the entire time they have been alive.

Mr. SERRANO. Wow. Well, I am glad to hear your enthusiasm about the future, because I was getting concerned, and so were some people I know, about how excited is the American public about the NASA program and what it means. And with some of the things you told the Chairman that are in the works and the plans, it may revive what appears to have been lost. And I will use the word "appears."

Secondly, let me tell you that I witnessed, as all Members of Congress have, the great feeling you get in a school building when an astronaut visits. I don't know if you have ever had that experience.

Mr. LIGHTFOOT. Yes.

Mr. SERRANO. I mean, it is just absolutely incredible. I mean, these are heroes. This is something children from everywhere in the world understand, the unknown, the space travel, the rocket ships, or whatever.

I remember we had a ceremony once where we had flown a flag, we were presenting it to a school, and the astronaut came to present it. Well, most of the people then, "What did you go to today?" "Well, I went to see an astronaut." No, you went to see a flag being presented to a school, but it became that kind of thing. So please keep that kind of work up.

NASA AERONAUTICS

And let me just ask you one last question. The administration is proposing a 36 million dollar cut to the Aeronautics Account—that is what I get for not wearing my glasses—which supports technological advances to our air transportation system and the aviation industry.

At a time when the global economy is extremely competitive, don't you think this cut is ill-advised if we are to maintain U.S. technological leadership in the aviation industry? Also, could you explain the most recent achievements attained as a result of our subcommittee funding this account and how the American people benefit from it?

Mr. LIGHTFOOT. Yes. There are several things there.

Aeronautics. There is a new initiative called New Aviation Horizon which has several pieces in it. For the first time in—I guess I just don't know when—but for the first time we have an X-plane. This is going to be the X-plane program, which is what NASA used to do in their heyday in aeronautics.

The first one is a low-boom supersonic demonstrator or flight demonstrator. This is for us to demonstrate that you can actually fly supersonic across the United States. Today you can't legally do that because of the sonic boom. We think that opens an entire industry in this Nation. We need to go—we, NASA—need to go make sure we have got the technology to allow us to do it, and then give it to the industry and let them run with it and create the aircraft they need.

The other things that we do with the budget we have got is the air traffic management—big, big issue with us—with our partners at FAA. We do a great job with those guys.

The last thing I will say that we are really working on a lot is the traffic management of drones. Our teams are working really, really hard with the FAA and building the systems that we would do to do traffic management around the unmanned aircraft systems, the UTM, the traffic management of these unmanned drones flying around. Our teams are leading the way there with the research we are doing at Ames Research Center in particular. They are just doing a great job leading that.

I think that is what you are getting, and I think that is what our customers are getting. I consider our customers our taxpayers out there.

Mr. SERRANO. Thank you.

I will leave you with this thought. Since I represent the Bronx, New York, if you could send the Red Sox on a long, long trip, I will be very grateful.

Thank you. Thank you for your work, and thank you for your service to our country.

Mr. LIGHTFOOT. Thank you, sir.

Mr. CULBERSON. Thank you, Mr. Serrano.

Mr. Cartwright.

Mr. CARTWRIGHT. Thank you, Mr. Chairman.

I would like to associate myself with the remarks of the ranking member except for the part about baseball.

Mr. Lightfoot, I want to follow up. The administration is proposing to terminate the NASA Office of Education. The requested fiscal year 2018 budget for the office would support only the closeout and transition of existing activities. As you did include in your testimony, the Science Mission Directorate, SMD, would continue to support certain educational activities, but not the existing programs of the Office of Education.

NASA EDUCATION PROGRAMS

The question is, why has the administration chosen not to support programs such as the Space Grant Consortia, the NASA established program to stimulate competitive research, as well as the Minority University Research and Education Project?

Mr. LIGHTFOOT. I think for us, as I said earlier, I think it is just a way of looking at more efficiently and effectively measuring our input with the community and how do we engage these students.

The activities that our mission directorates do, the Centennial Challenges that the gentleman from West Virginia talked about earlier, those are the kind of ways that we think we can engage and still get the—we won't get the same. I am not going to try to fool you and say we get the same engagement today that we do with what we have today. That is the way we are going to try to pull our outreach and education together to actually implement this new plan here.

The Office of Education itself, the actual office, one of the reasons that we—we wanted to figure out a better way to run that instead of having it—and so that is something that is going to happen either way. We are going to figure out a way to run that differently, to be a more effective delivery arm for what we want to do with our education programs.

That is the proposal that is out there, and we think we are going to try to balance the outreach and the education as best we can to still reach as many folks as we can.

Mr. CARTWRIGHT. And I wanted to ask you about the analysis leading up to that. Was it a determination that the Office of Education wasn't working well or was it just we have to save some money?

Mr. LIGHTFOOT. A little of both.

Mr. CARTWRIGHT. OK. What analysis has the administration conducted to determine the impact of ending these particular programs?

Mr. LIGHTFOOT. I think what we did is we looked at some of the metrics that we have related to the effectiveness of some of those campaigns that we do. Again, in the tight budget considerations we had, we just had to make some decisions around that. That is what we did.

Mr. CARTWRIGHT. Can you speak to how the closeout of NASA EPSCoR being coordinated with other agencies will be affected, other agencies that have EPSCoR programs?

Mr. LIGHTFOOT. I would probably have to take that one for the record, if that is OK, because I am not sure I know that off the top of my head in terms of exactly how they impact. I know we are coordinating with them. That is why we got the money in 2018 to do that, but the exact coordination, I would rather bring that back, if that is OK.

Mr. CARTWRIGHT. Absolutely OK. I would rather not have you just wing it.

Mr. LIGHTFOOT. Yes.

EARTH SCIENCE RESEARCH

Mr. CARTWRIGHT. Now, the proposed budget includes a steep $59 million cut to Earth science research grants, and this could have a significant impact on the U.S.'s global leadership in science. Has there been a decrease in applications for these grants?

Mr. LIGHTFOOT. No. I think it was just, again, a balancing that we were trying to do internal to all the grants that we do. That is where we went.

Mr. CARTWRIGHT. Can you speak to what extent would reducing this funding reduce the return on NASA's past investments in developing and launching Earth science satellites?

Mr. LIGHTFOOT. Well, we still continue to launch satellites. We are going to launch two in 2018. We still have 20 missions up there. We still have our science research and analysis activities that go on where we do the research and analysis. This is just doing—it is just less money in that area, but we are still going to be doing that kind of assessment and analysis.

Mr. CARTWRIGHT. Can you talk to us about what impact the proposed reductions would have on Earth science researchers and graduate students at United States universities?

Mr. LIGHTFOOT. I think, again, it depends on how much we have out there to provide those grants. We don't know that complete impact at this time. We just know that we will still have folks doing work and doing work in these areas. I just can't tell you exactly what the impact would be until we implement it.

Mr. CARTWRIGHT. I thank you, Mr. Lightfoot.

I thank you, Mr. Chairman. I yield back.

SPACE LAUNCH SYSTEM

Mr. CULBERSON. Thank you, Mr. Cartwright.

Administrator, I wanted to ask about the cost of an SLS launch. It is a very large, capable rocket that is urgently needed to preserve American leadership in space exploration and will dramatically decrease travel time to distant destinations. The launch costs are going to be pivotal. When will that data per cost of launch at SLS be available? And how much do you anticipate it will cost for NASA to launch an SLS with a science payload, for example?

Mr. LIGHTFOOT. We are working on what we call the production and ops mode because we are still in the first build of these. What we are doing is we are putting out—we put out requests for folks to tell us what would be the production and ops cost so we can drive that down. We expect to see that sometime later this summer. We will understand what it is going to be once we start a cadence of flights as opposed to this first build going forward.

Mr. CULBERSON. OK. What was the cost of the launch of the shuttle, for example?

Mr. LIGHTFOOT. Oh, gosh. I will have to get you that.

Mr. CULBERSON. If you remember?

Mr. LIGHTFOOT. I will provide that for the record.

Mr. CULBERSON. That is OK.

Can you talk to us about the length of time it will take the SLS to reach Europa, for example, on the Evolved Expendable Launch Vehicle?

Mr. LIGHTFOOT. The SLS versus an EELV? Is that what you are saying?

Mr. CULBERSON. Yes.

Mr. LIGHTFOOT. It is about 3, 3½ years. It is a pretty dramatic difference.

Mr. CULBERSON. It makes a significant difference. And that enables the scientists to do the data—see the data and do the work that much earlier.

I have got some other questions I will submit for the record. Do you want any others?

Mr. SERRANO. I have one more to submit for the record.

Mr. CULBERSON. OK. Very good.

Mr. Cartwright.

Mr. CARTWRIGHT. No.

Mr. CULBERSON. All of us on this subcommittee are proud of the work that you do at NASA and all the fine men and women that make our space program the very best on Earth. We look forward to continuing to support your work. We thank you very much for joining us here today and for your service to the Nation.

Thank you, very much, Mr. Lightfoot. The hearing is adjourned.

Mr. LIGHTFOOT. Thank you for your support.

The Honorable John A. Culberson
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Questions for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Commercial Crew

Question 1a:

The fiscal year 2018 budget includes $732 million for the Commercial Crew program. This amount is a reduction of some $453 million below the FY 2017 enacted level. The Commercial Crew program is intended to establish safe and reliable transportation to and from the United States to the International Space Station no later than 2017. The launch dates for both Boeing and SpaceX have slipped significantly, with each contractor determining that they will not be able to meet their original 2017 certification dates.

a. In general, please describe why each of the programs are delayed and steps NASA is taking to work with the contractors to ensure that the programs proceed apace while not compromising crew safety.

Answer 1a:

In general, recent delays associated with the partners' commercial crew contract schedules reflect normal development difficulties and technical challenges associated with human space transportation systems. The Commercial Crew Program is currently tracking specific technical and programmatic risks that could result in additional schedule delays; the program updates Congress on progress quarterly. Schedule is important, but safe design of the vehicles is mandatory. Because these contracts are fixed-price, delays have not resulted in additional costs to the U.S. government for developing the vehicles.

Question 1b:

b Please describe NASA's process of overseeing these contracts, especially with respect to crew safety. Further, does NASA have full insight into the costs of each program?

Answer 1b:

NASA's level of oversight and insight are specified in the CCtCap contracts, and these levels are sufficient to enable NASA to ensure that the vehicles are meeting NASA's safety and performance requirements.

- Oversight authority is provided via contract clause E.2, Inspection of Services and Research and Development Work, in both CCtCap contracts. A brief quote from that clause states "The Government has the right to inspect and test all services and R&D work called for by contract, to the extent practicable at all times and places during the term of the contract." This broad authority should be adequate for all oversight activities.

- Insight authority is provided via clause H.15, Government Insight, in both CCtCap contracts. That clause requires, in part, that, "The Contractor shall provide … access to all Contractor activities … under this contract." This is broad access that is fully adequate for NASA to monitor activities during performance.

The contract also requires submission of specified data deliverables, reports, review packages and plans throughout contract performance to enable the Government to continuously monitor and assess contractor performance.

NASA's Commercial Crew Program has prioritized crew safety throughout its development and certification phases, including the Certification Products Contracts (CPC) and Commercial Crew Transportation Capability (CCtCap) contracts with industry. NASA is confident the insight and oversight requirements in the CCtCap contracts will ensure commercial crew transportation systems meet the Agency's safety and certification requirements. NASA has worked carefully and diligently to assure our safety requirements span all mission phases and adequately address all credible hazards, including pad emergencies, in-flight aborts and emergency landings.

The contract has fixed prices for the completion of development for each company's crew transportation system, as well as fixed prices for each mission. We therefore know precisely how much taxpayer funds will be spent on the complete development of a new human-rated spacecraft system and on the missions to be flown after the systems are certified. NASA has detailed requirements associated with the fixed price line items for the contracts. We therefore have complete insight into what will be delivered for the predetermined amount of dollars. Further, the contract requires periodic reporting by the contractor on its schedule, milestone progress, and associated costs.

SLS, Orion, and Associated Ground Systems

Question 2a:

The fiscal year 2018 budget includes $2 billion for SLS, $1.2 billion for Orion, and $460 million for associated ground systems. The Congress has provided more than $26 billion to these programs writ large over the last decade.

Why is EM-1, the first un-crewed flight, slipping beyond 2018?

Answer 2a:

While the progress to date on Orion, the Space Launch System (SLS), and Ground Systems Development and Operations (GSDO) has been substantial, NASA and its partners are in the process of resolving technical and schedule issues in certain critical areas. These issues include first-time production issues for the SLS core stage, and integrated manufacturing, test, and processing schedule projections for the Orion service module being supplied by the European Space Agency. Early production issues are not unprecedented for an activity of this scope and ambition. The tornado that impacted the Michoud Assembly Facility (MAF) this past February also contributed some additional schedule problems. While the schedule assessment continues, NASA is increasing the contractor production workforce at MAF, increasing involvement in resolving vendor technical and schedule performance issues, and assessing opportunities for improving the efficiency of enterprise integration activities. NASA is assessing alternatives for optimizing EM-1 completion, based on possible hardware delivery sequences, dependencies, and reserve strategies.

Question 2b:

When will EM-2, the first crewed flight, likely occur?

Answer 2b:

EM-2 is slated to fly not later than 2023

Question 2c:

Given slip to EM-1, will there be adequate time to modify the ground infrastructure at Kennedy following EM-1 and in advance of EM-2?

Answer 2c:

NASA estimates that there will be adequate time to modify the ground infrastructure at Kennedy Space Center following EM-1 to accommodate the launch of a Block 1B EM-2 no later than 2023. This includes modifications to the Mobile Launcher, propellant capabilities at the launch pad, and platforms in the Vehicle Assembly Building to make these facilities compatible with the SLS Block 1B with Exploration Upper Stage.

Question 2d:

Following EM-2, when will the next crewed flight occur?

Answer 2d:

While the schedule for subsequent Exploration Missions has not been finalized, EM-3 could fly as early as the year after EM-2.

Question 2e:

What are the estimated SLS launch costs?

Answer 2e:

NASA is focused on completing SLS development, producing the first SLS flight articles, and ensuring a sustained cadence of exploration missions that will ensure continued U.S. leadership in deep space exploration through the 2020s and beyond. Although it is premature to provide a detailed cost for an SLS launch at this stage in the program's life cycle, NASA's preliminary estimate for the marginal cost of an SLS launch early in the program's production and operations phase is on the order of $0.7 – 1.0 billion, which represents the cost of a second SLS in a given year where the fixed costs are covered by the first SLS launch. This preliminary estimate of the marginal cost includes the SLS core stage, boosters, and Exploration Upper Stage, but does not include Orion and/or cargo elements, or enterprise/ground operations and integration costs. NASA has assessed the results from a recent affordability Request for Information (RFI) and will work with industry to reduce overall costs once SLS and ground systems enter the production and operations phase.

Question 2f:

Is NASA examining reusability with respect to future SLS production?

Answer 2f:

NASA does not intend to pursue reusability with respect to future SLS production. Adding systems to recover or reuse SLS components includes tradeoffs with additional mass.

Question 2g:

Will subsequent Orion capsules be reusable?

Answer 2g:

The Orion used in EFT-1 may be refurbished and utilized for the Ascent Abort-2 test. For future Exploration Missions, NASA is reviewing the ability to reuse internal components, such as avionics boxes, focusing on feasibility and the economic benefit. Similarly, the Agency will examine the potential for reusing the Command Module structure, itself; whether or not this will be feasible, given the exposure of the spacecraft structure to the salt water environment encountered on splashdown, is to be determined.

Cybersecurity

Question 3a:

The budget includes an increase to accelerate personal identity verification compliance; improve the detection and response to malicious activity; to develop and deploy information technology (IT) portfolio tools and processes; support establishment of an IT Investment Fund (ITIF); implementing agency's compliance with the Federal IT Acquisition Reform Act (FITARA); and cybersecurity. The ITIF was created to afford the NASA Chief Information Officer (CIO) increased visibility and involvement in the management and oversight of IT resources across the Agency.

Has NASA implemented all of the recent security measures recommended by the National Academy of Public Administration, the Government Accountability Office, and the Inspector General with respect to center security and cyber security?

Answer 3a:

NASA has completed several security measures recommended by the National Academy of Public Administration, ranging from identity management actions to data protection. The Agency continues to complete recommendations from the Inspector General and Government Accountability Office, some of which will be complete in FY 2019. NASA completes recommendations on a continual basis, and actively strives to improve its cybersecurity posture. The Agency routinely accepts IG and GAO recommendations, and approaches mitigating findings as an ongoing function of NASA cybersecurity.

The budget includes a $32 million increase to accelerate personal identity verification compliance; improve the detection and response to malicious activity; and to develop and deploy information technology (IT) portfolio tools and processes. NASA established an IT Investment Fund (ITIF) to serve as a funding source to address obsolescence and strategic investments in IT advancements and enterprise solutions. Examples of investments that could be funded through the ITIF include corporate network obsolescence issues, application upgrades, etc.

Question 3b:

Under the auspices of the ITIF, will the CIO be able to exercise more decision making over IT investments and security compliance throughout NASA?

Answer 3b:

Allocation of the IT Investment Fund will be accomplished through a transparent and inclusive prioritization process, leveraging the IT Council. The ITIF, in and of itself, does not provide the ability to exercise more decision making over IT investments and security compliance.

NASA is implementing several policy enforcement and enhancement efforts to improve NASA's ability to comply with the requirements of the Federal Information Technology and Acquisition Reform Act (FITARA). NASA has established an IT Council comprised of NASA senior leaders across the Center and Mission Directorate stakeholders. The ITC serves as the Agency's senior information technology (IT) decision-making body focused on information resources management IRM), including information management and information technology. Council members are advisors to the NASA Chief Information Officer (CIO), who is the ITC Chair and decision authority. The scope and authority of the ITC encompasses the portfolio of all information resources management activities conducted by NASA. This portfolio includes all current and future investments, bot developmental and operational, regardless of funding source. The ITC is the governing council for IT Authority for all NASA IT, including highly-specialized IT, for purposes of policy such as, but not limited to, information security, investment insight, and architecture alignment. Beginning with IT portfolio identification, NASA is expanding CIO insight into IT funding requests for services and investments. The early identification of IT investments will provide the insight needed to ensure security compliance at the beginning of the IT lifecycle.

Question 3c:

What advantages does the ITIF afford the CIO? Does the "detection and response" proposed activity overlap with similar services provided by DHS?

Answer 3c:

The CIO is proposing to create an IT Investment Fund (ITIF) to plan, evaluate and manage new IT investments for the Agency. The process will be open to accept proposals from Center and Missions, and will be evaluated on factors such as, but not limited to, strategic alignment, cost savings and risk aversion.

Evaluation and selections of the IT investments will have buy-in from the IT Council, which is a joint board of senior leadership from the CIO community as well as Center and Mission Directorate stakeholders. Below are some other major benefits anticipated as a result of implementation of the ITIF:

- Provide a structured and integrated approach to risk based solutions for IT operations and infrastructure.
- Create funding mechanisms for long standing obsolesce funding issues and the needs of future capabilities.
- Identification of duplicative efforts and increase transparency of IT priorities.

- Integrate the delivery of new technologies within portfolio scope.

NASA operates services and initiatives which enhance the Agency's ability to detect and respond to threats and events. A significant enhancement to the Agency's cybersecurity posture is the implementation of DHS' Continuous Diagnostics & Mitigation (CDM) program phase 1. CDM phase 1 focuses on endpoint integrity and equips NASA with enhanced tools to perform vulnerability scans, and implement a robust hardware and software asset management program. NASA is fully committed to the CDM program and is currently deploying the tools across the Agency IT infrastructure. Complementary tools are being implemented or are currently deployed that enable the Agency cybersecurity staff to identify and detect threats to those critical IT assets. These capabilities focus on network monitoring for anomalous activity and respond to those events.

Human Research Program

Question 4a:

The budget includes $140 million for human research programs.

What activities will this request support and is this funding sufficient to address the myriad of health concerns that must be mitigated prior to humans undertaking long-duration space flight?

Answer 4a:

NASA's Human Research Program (HRP) has developed an overarching space human health risk architecture that focuses its research on the highest risks associated with future human exploration missions. Crew health and performance is critical to successful human exploration beyond low Earth orbit. HRP investigates and mitigates the highest risks to human health and performance, providing essential countermeasures and technologies for human space exploration. Risks include physiological effects from radiation, hypogravity, and terrestrial environments, as well as unique challenges in medical support, human factors, and behavioral health support. The HRP utilizes an Integrated Research Plan (IRP) to identify the approach and research activities planned to address these risks, which are assigned to specific Elements within the program.

NASA uses HRP's risk reduction plan to chart progress in reducing the risk in 25 human health and performance areas important to deep-space exploration. The Integrated Path to Risk Reduction chart, which shows progress in the 25 areas, can be accessed at the website below:

https://humanresearchroadmap.nasa.gov/intro/

Question 4b:

NASA has established the Translational Research Institute (TRI) to address human health concerns on long-duration space flight. Please provide a list of research grants provided thus far under the TRI program.

Answer 4b:

As part of its mission to lead a national effort in applying cutting edge terrestrial research to spaceflight human risk mitigation strategies for long-duration exploration missions, the Translational

Research Institute (TRI) released its first research announcement in March 2017. Research topics included the following:

1) Omics capabilities for use during missions,
2) Long lasting medications,
3) Human brain imaging,
4) Inflight surgical capabilities,
5) Increase an organism's resistance to radiation,
6) Preserve muscle mass with pharmaceuticals,
7) Inflight production of fresh food,
8) Microbiome based therapies for improving health in spaceflight, and
9) Lymphatic imaging in microgravity.

External peer review of the 98 proposals received under the first TRI research announcement are currently ongoing with announcement of awards scheduled for August 2017. Additionally, the TRI released a Postdoctoral Fellowship Call with applications due July 2017 and announcement of selections in the fall.

New Operating Model

Question 5a:

Please describe the New Operating Model.

Answer 5a:

To carry NASA into a productive future in aeronautics and space, the Agency is implementing an Agency operating model, within the Agency implementation framework that maintains critical skills and infrastructure that meets current and 21st century mission needs, with the following objectives:

- Place the ability to meet Agency goals first;
- Grow best-in-class capabilities by aligning to recognized Centers;
- Match technical capabilities with mission need;
- Enable mutual dependencies amongst Centers, programs, and leadership team; and,
- Build flexibility in the Mission Support budget by reducing footprint and duplication.

In 2014, the Agency began moving forward with the following key initiatives related to the Agency Operating Model:

Capability Leadership Model: The Capability Leadership Model enables *stewardship* of NASA's critical capabilities, *awareness* by senior management of capability health, and *sustainment* of Center capabilities to meet mission needs. This new construct enables horizontal integration of NASA's capabilities, as well as a way to tap the skills NASA needs to accomplish its mission, no matter where those skills reside. Capabilities are delineated in the following categories: engineering disciplines, systems, scientific research, and services. Capability Leadership specifically addresses the following roles:

- Advises Agency and ensures *proper alignment* across Missions and Centers.
- Establishes *plans/roadmaps* to provide technical guidance to the Agency.
- Determines *gap areas* for advancement and strategic investment.
- Advises on capability *sizing and strategic hiring* across all Centers.

- Determines *investments and divestments* within capability scope, including advising Centers on assets.
- Solicits *innovative ideas* from outside the capability area.
- Establishes *standards and specifications* within capability scope.

Business Services Assessment: The Business Services Assessment (BSA) initiative is a bottoms-up, analytical approach to evaluate the health of each business service area and identify opportunities for optimization. The BSA is enabling NASA leadership to make informed decisions on investing/divesting strategically within the budget while strengthening innovation in critical areas. Some examples of results from the BSA assessments include:

- *Information Technology* - Consolidated various SharePoint collaboration environment instances across NASA to achieve a cost avoidance of ~$7M/year.
- *Procurement* - SSC will award and administer a new multiple award construction contract to be used by four Centers (SSC, JSC, KSC, MSFC).
- *Human Capital* - Selected a new hiring system that will replace the current outdated system and modernize hiring of employees by providing managers more flexibility in selections.

As a result of the BSA efforts, NASA is pursuing a Mission Support Architecture. Rather than following the traditional model of sustaining Center-centric services with large-scale duplication, NASA's Mission Support Architecture effort enables a functional alignment model, regardless of location. Such a model allows for the function to determine the optimum approach to meet mission needs, with an Agency perspective rather than a Center perspective. With the NASA missions as the customer, the functional area can drive toward Agency-wide support, integrated structures, streamlined management, common systems/tools, and access to workforce expertise wherever they may reside

Strategic Workforce Planning: Much like the strategic planning NASA performs for program budgets and Center facility master plans, the Agency is implementing an approach to Strategic Workforce Planning (SWP) that will improve how each Center forecasts their workforce capacity based on mission demands and demographic shifts. The SWP process will be connected to the annual budget process to capture a 5-year work horizon, with a longer timeframe perspective captured in each Center's strategic workforce plan as maintained by the Office of Human Capital Management. For 2016, the SWP efforts focused on identifying and codifying the Center roles. It defines Center primary and support roles and sets a long-term vector for the workforce to grow in the right skill areas to meet the future mission needs.

Question 5b:

Please describe how the Centers been involved in developing this New Operating Model?

Answer 5b:

The NASA Centers are involved in developing the Agency Operating Model through various pathways, depending on the initiative. Here are the primary opportunities for engagement in shaping and executing the model:

- Center Directors are actively engaged in the Agency Operating Model as members of the NASA senior leadership team. This team meets informally on a quarterly basis to discuss initiatives and work in splinter groups to address key concerns or approaches. The Center Directors are also part of the decision-making process as members of the governance councils. The Mission Support Council and the Program Management Council are used to deliberate Operating Model recommendations, and codify in decision memos. The Centers have full representation as well as the opportunity to provide written comments.

- At various tiers of effort, Center personnel are engaged in Agency Operating Model efforts. For Capability Leadership, the subject matter experts, located at various Centers, lead the teams and deliver recommendations to senior leadership. Most notably, the Engineering Management Board, that oversees the discipline and system Capability Leadership products, is comprised of all the Center Engineering Directors. For the BSA, Center personnel lead the assessments, serve on the steering committee, and contribute to implementation plans.

Question 5c:

Does this mean that some Centers will no longer be involved in certain mission areas?

Answer 5c:

As part of Strategic Workforce Planning, the NASA senior leadership agreed to a set of Center Roles. This decision codified each Center's primary roles (leader/focal point) and support roles (enhances primary/niche area), as well as areas for divestment. These designations encompass both technical/programmatic and mission support roles. By clearly stating each Center's areas of expertise, mission work assignments are more clearly framed and executed in the near-term through the budget process as well as the farther-term through the strategic workforce planning process.

Question 5d:

Is NASA consolidating at headquarters any processes that were formerly done at the Centers?

Answer 5d:

NASA is initiating new ways of doing business over the next 10 years to ensure that the Agency can support the future mission needs with more agile, flexible and lower cost services.

Rather than following the traditional model of sustaining Center-centric services with large-scale duplication, NASA's Mission Support Architecture effort enables a functional alignment model, regardless of location. Such a model allows for the function to determine the optimum approach to meet mission needs, with an Agency perspective rather than a Center perspective. With the NASA missions as the customer, the functional area can drive toward Agency-wide support, integrated structures, streamlined management, common systems/tools, and access to workforce expertise wherever they may reside. Processes will still be performed at Centers, but through a leadership model steered from Headquarters.

The Honorable John A. Culberson
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Material for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Material for the record for Congressman Culberson regarding Discovery and New Frontiers Programs

Question:

Culberson: Could you talk to us about any –are there, for example, new frontier – is there a new frontiers mission being considered for Enceladus? Talk to us a little bit about why Enceladus is important.

Lightfoot: Well, obviously, Enceladus is important for the same reason Europa is. We think it is a place where we could find some of the origins of life or different life that could be there. The New Frontiers program is going to stay on its standard cadence that we will put out here shortly, and we think we have got the money to do that as—

Culberson: Every other year?

Lightfoot: I believe we are at 3 years, is where we are right now, 2-1/2 to 3 years. But let me make sure of that. Let me get you—I will take that one to make sure I am exactly right. I don't want to guess here.

Answer:

NASA plans to launch one Discovery mission on average every 2.5 to 3 years. NASA's current commitment for New Frontiers missions is an average rate of one launch every 5 years, with a longer-term goal of reducing this timeframe to one every 4 years. With the recent release of the New Frontiers 4 Announcement of Opportunity, NASA expects to select a new mission in 2019.

Material for the record by Congressman Culberson regarding Cost of Launch Shuttle

Question: What was the cost of the launch of the shuttle, for example? If you remember?

Answer:

By accounting for all funding for the Space Shuttle program over its history by the total number of flights, the estimated cost is $1.73B per flight in program year 2017 dollars. This is not necessarily a per-flight cost, as the Shuttle program costs accounted for much more than the launch costs. For example: the Shuttle program costs included the astronaut office cost, Ellington field operations, the EVA office and Marshall Space Flight Center payload operations costs. It is not possible to back out these additional covered costs. Therefore, this Shuttle flight cost should be considered a maximum per-flight cost. Looking historically at the data, the non-flight-specific costs could be as high as 50 percent. This assumption would yield the low end Shuttle lifetime per-flight cost at $863M in program year 2017 dollars. Therefore, the Shuttle per-flight cost estimate would range from $863M to $1.73B for the life of the program.

The Honorable Robert Aderholt
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Questions for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Question 1a:

Please provide a breakout of plans for STMD spending of the FY17 $35 million designated by Congress for nuclear propulsion. (Note: kilopower work is not nuclear propulsion).

Answer 1a:

The Agency transmitted its Operating Plan to the Committee on 6/27/2017.

Total Nuclear Propulsion Systems investments in FY17: $35M

- **$19.2M,** Game Changing Development/Nuclear Thermal Propulsion. STMD initiated a 3-year NTP development activity in FY 2016, with the overall goal to determine the feasibility and affordability of a low-enriched uranium based engine system. Critical nuclear propulsion technologies being evaluated include: (a) the viability of a low-enriched uranium system as a more affordable pathway to development of a nuclear rocket engine; and, (b) the approach to maintaining long-term on-orbit storage of cryogenic hydrogen. NASA will evaluate the progress made on the initial three-year technology development effort

  STMD's FY 2017 plan adds $12.3M (included in the $19.2M) to this effort above the Annualized CR or FY 2017 PBR funding level. The Nuclear Thermal Propulsion (NTP) project currently includes a ground demonstration of a Ceramic Metallic (Cermet) Fuel Element (FE) that will undergo non-nuclear thermal testing in a relevant environment with hydrogen flow through the cooling channels. This test will demonstrate the feasibility of using a Cermet FE in a Low Enriched Uranium (LEU) NTP engine. Additional funding provided in FY17 will allow for alternate fuel/reactor conceptual design and analysis efforts; add critical cryogenic fluid management activities including main propulsion system design and overall operations concepts; and also allow the subscale demonstration of the fully contained exhaust test concept at Stennis Space Center (SSC) for a NTP engine. The fully contained exhaust testing will enable a safe and affordable way to test a LEU NTP engine. These demonstrations contribute to determining the overall feasibility of a LEU NTP engine and reduce the risk for proceeding with further ground demonstrations in the future.

- Additional efforts in STMD's FY 2017 plan are key to successful Nuclear Thermal Propulsion system:
  - **$10.2M** for propellant transfer and thermal management technologies (eCryo, GCD cryocooler and RRM3 added instrumentation to aid in critical modeling of cryogenic systems). These activities target enabling zero boil-off of cryogenic fluids in-space, with an ultimate goal of liquid hydrogen, which is a critical technology development need for NTP.

- $3.0M **for Game Changing Development's kilopower activities that are relevant and needed for NTP. Kilopower is developing a compact, scalable fission power system for science and exploration missions. Kilopwer activities relevant to NTP include: uranium processing and manufacturing; BeO neutron reflector; reactor control systems; radiation tolerant instrument and control; CFD and finite element modeling; and integrated multi-physics nuclear codes.**
- **$2.6M** for SBIR/STTR awards made to advance NTP technologies.

Question 1b:

Please provide an outline of the 4-year, $250 million plan and how the FY17 $35 million is a part of that.

Answer 1b:

NASA does not have a 4-year $250 million plan within the FY 2018 budget request. The agency is currently assessing the viability of low enriched uranium (LEU) fuel elements, evaluating the reactor and engine designs, and developing cost and schedule estimates. We should have a better understanding of these important drivers toward the end of FY 2018, and can present an informed potential path forward once these ongoing efforts are completed.

Question 2:

Please provide a spend plan for the FY17 Small Launch Vehicle funding. (Note: the answer to the QFR submitted last year regarding this program does not align with Congressional intent).

Answer 2:

The Agency transmitted its Operating Plan to the Committee on 6/27/2017.

Approximate investment in small launch capabilities in FY17: $23.3M.

NASA has been actively seeding cost effective access to space using emerging commercial nano-launch capabilities, including the new Venture Class Launch Services (VCLS), public-private partnerships to advance enabling technologies, and the CubeSat Launch Initiative (CSLI). In support of small launch capabilities, STMD has been fully utilizing its technology pipeline to mature the technologies needed to make spaceflight more affordable for payloads of all sizes. There are a number of companies who have a strong interest in this market. We have made the investments below through a variety of competitive solicitations.

- **$18.5M**, Flight Opportunities, FY17 ($15M) and FY16 unobligated carryover ($3.5M) funding invested in flight demonstrations of technologies (REDDI solicitation and NASA internal calls); and to advance Small Launch capabilities competitively selected through the Tipping Point and Announcement of Collaborative Opportunities (ACO) solicitations. ACO and Tipping Point public-private partnerships-are targeted to the emerging small launch vehicle industry. The distribution of this funding includes:
  - $3.5M for ongoing activities from prior year awards, as well as program and CSLI support
  - $2.2M for payloads selected as part of the REDDI solicitation. These payloads provide a flight demand for the multiple launch services providers under contract to Flight Opportunities.

- $8.8M for small launch technologies projects that were selected as part of the ACO 15 and Tipping Point 16 and the ACO 17 solicitations.
- $4.0M will be added to make additional awards to enhance the capabilities of the small launch vehicle industry through Tipping Point and ACO awards.

- **$2.2M**, GCD Tipping Point partnership to test and advance DESLA Upper Stage engine, a dual-expander liquid hydrogen/oxygen upper stage engine for use in small and mid-sized launch systems.
- **$2.6M**, SBIR/STTR towards targeted subtopics for small launch vehicle technologies including innovative propulsion technologies, affordable guidance, navigation and control, manufacturing and structure innovations, stage level system technologies, plug-and-play architecture, and propulsive flight testing.

Question 3:

I would like to get an update on the cost of human-rating the ICPS stage. I still believe this idea is a bad plan. I have heard the cost may now be as high as $1 billion. What is the latest estimate?

Answer 3:

The latest estimate of cost to human rate the Interim Cryogenic Propulsion Stage (ICPS), reviewed during the options presented as NASA looked at flying crew on EM-1, is $90M.

Question 4:

Last year's answer to question 4.e. is not accurate. At least one applicant provide flights to the ISS as part of the Commercial Crew program has the proposed price broadcast on its web site. It is therefore not SBU information. Please revisit this question and provide an answer.

Answer 4:

The pre-negotiation per-seat offer price for the two CCtCap systems is considered Sensitive But Unclassified because it would give each company insight into its competitor's pricing. Should a company elect to provide its per-seat offer price publically, that is their prerogative. NASA is not aware of either partner has publicly releasing the contractual price for Commercial Crew missions to the ISS. The current contract values for CCtCap are $4.1B and $2.5B for Boeing and SpaceX, respectively, which includes design, development, test, and evaluation (DDTE), certification, six post-certification missions (each provider), and special studies.

Question 5a

The CRS-1 contract with SpaceX required a new Dragon vehicle for each CRS flight; is that correct?

Answer 5a:

The Commercial Resupply Services (CRS) contract with SpaceX does not require a new Dragon vehicle for each CRS flight. NASA did review the details of the refurbishment process in order to determine if the reflown Dragon would meet the needs for the proposed cargo flight.

Question 5b:

Who at NASA authorized SpaceX to utilize a used Dragon capsule on a CRS flight for NASA?

Answer 5b:

n/a (please see response to Question #5a, above).

Question 5c:

I assume NASA (i.e., the taxpayer) received a reduced price for this flight; what was the dollar amount of the discount?

Answer 5c:

Under the CRS contract, NASA procures a service of upmass and downmass deliveries from SpaceX. It is up to the commercial partner to determine how best to meet its contractual obligations; whether a Dragon cargo vehicle has previously been flown does not factor into the price.

Question 6a:

Does NASA plan to fly 7 persons at a time on the SpaceX Dragon capsule Commercial Crew flights?

Answer 6a:

NASA plans to fly four persons at a time on a typical SpaceX Crew Dragon flight.

Question 6b:

Does NASA plan to fly astronauts on used Dragon capsules?

Answer 6b:

Under the commercial crew contracts, NASA procures the transportation of astronauts to and from the International Space Station (ISS). It is up to the commercial partner to determine how best to meet its contractual obligations including satisfaction of NASA's safety standards. The complete transportation system that each partner will use must be certified by NASA prior to operational missions. To date, SpaceX has not indicated that they plan to use previously-flown Dragon capsules to the ISS for crewed missions.

Question 7a:

China has been very active in landing payloads on the Moon in recent years, and has plans to continue this effort over the next two years with the Chang'E 4 and Chang'E 5 missions, including with a landing on the far side of the Moon for the first time in human history. These missions make China only the third country capable of landing on the Moon, after U.S. and Soviet missions in the 1960s and 1970s.

In fact, the U.S. has not had a lunar lander since the end of the Apollo program in 1972, which has left a void in NASA's ability to conduct Lunar surface science, technology demonstrations and explore opportunities for future human missions to the Moon. How can NASA's Advanced Exploration Systems office, which has been leading the Lunar CATALYST program in partnership with U.S. lunar lander providers like Astrobotic, best leverage these new private sector capabilities to enable greater opportunities for NASA's science and exploration missions?

Answer 7a:

NASA is supporting the development of commercial lunar exploration. In 2014, NASA introduced Lunar CATALYST (Lunar Cargo Transportation and Landing by Soft Touchdown) and entered into competitively awarded partnerships with three U.S. firms to provide in-kind support to develop commercial lunar robotic landing capabilities. NASA is providing engineering expertise, hardware and software, and test facilities to these companies. The purpose of the initiative is to encourage the development of U.S. private-sector robotic lunar landers capable of successfully delivering payloads to the lunar surface using U.S. commercial launch capabilities. Initial flights of commercial lunar landers may begin as early as late 2017 or 2018, and as a result one or more of these companies will be able to market lunar payload delivery services for small instruments and technology demonstrations. Commercial lunar transportation capabilities could support science and exploration objectives such as sample returns, geophysical network deployment, resource utilization, and technology advancements.

Question 7b:

Will there be opportunities to use these commercial lunar lander systems as secondary payloads on upcoming Exploration Missions using SLS and Orion?

Answer 7b:

The primary objectives of Exploration Missions will be to meet national goals and maintain U.S. leadership by extending human presence into deep space, including Mars. Secondary payload capability on exploration missions will be prioritized to payloads and capabilities that directly meet these overall strategic objectives in the most efficient and expeditious manner possible. Opportunities for additional secondary payloads will be based on mass, volume, and vehicle performance availability and assessed given the demand.

Question 8a:

For the last several years, NASA's Advanced Exploration Systems office has been working with U.S. industry to develop a robotic lunar lander delivery capability through the Lunar CATALYST program. This new capability would provide the U.S. with its first lunar lander since the end of the Apollo program in 1972 – nearly 50 years ago. On May 1, NASA released an RFI requesting information about American lunar lander providers that could be on contract to provide payload delivery services to the Moon for NASA's science, space technology and exploration directorates. It's my understanding that NASA plans to move forward with a program to solicit payloads from across the agency for a potential mission in 2019, the 50th anniversary of Apollo 11 lunar landing. Does NASA anticipate awarding FY17 contracts for this work?

Answer 8a:

NASA is interested in sending small payloads (<10 kg) to the lunar surface, and considering issuing a solicitation for such payload development in FY 2017. This could lead to one or more payloads that could be available for commercial transportation to the Moon as early as FY 2018. This would not be a dedicated NASA mission, but delivery of one or more small NASA payloads that are integrated onto a commercial mission, potentially with other, non-NASA payloads. NASA recently released a Request for Information to industry seeking responses on interest and ability to provide cargo transportation services to the lunar surface. This RFI is helping NASA perform market research to understand the extent of lunar surface transportation capabilities of U.S. industry, including NASA

Lunar CATALYST partners and other U.S. business entities. NASA has not yet issued a lunar cargo transportation solicitation, but is currently assessing options for doing so, with awards potentially as early as FY 2018.

Question 8b:

What are the next steps at NASA for selecting payloads and a robotic lunar lander service for the upcoming mission opportunity, and what resources would this Committee need to provide Advanced Exploration Systems in order to move forward with this mission within this timetable?

Answer 8b:

Regarding the potential commercial delivery of small NASA payloads to the Moon, NASA is considering solicitations for both payload development and lunar transportation services for those selected payloads, with delivery to the Moon possible as early as FY 2018.

Question 9

The Space Launch System is the Nation's and the world's most capable rocket under development. The first version will have a capability of 70mT or more. Is there a rocket under development that you know of with equivalent lift capability and cargo capability and the ability to cut travel time to destinations such as Europa by more than half?

Answer 9

NASA is not aware of any rocket currently in hardware development that would have a lift and cargo capability, particularly for deep space missions, equivalent to that of SLS.

Question 10a:

I am disappointed to see the launch date for EM-1 slip to 2019. Also, I consider a four-year gap to the year 2023 for the second SLS flight a troubling time gap for a nation as great as ours. I realize there are engineering tests and work related to using EUS for the first time. Please deliver to the Committee a budget plan which would launch EM-2 no later than 24 months after EM-1. To do less than creates unnecessary costs.

Answer 10a:

In addition to research and development for the EUS, there are substantial modifications that will need to be made to the Mobile Launcher, propellant infrastructure at Launch Pad 39B, and the Vehicle Assembly Building to enable the stacking, processing, and launch of the updated Block 1B. The scope of this work, particularly modifications to the Mobile Launcher, are at this point limited by the time needed to perform necessary engineering design, procurement, and hardware and software development. That necessary work on the Mobile Launcher (the largest modification project for SLS Block 1B) is expected to take a minimum of 33 months between the launch of EM-1 and launch readiness for EM-2.

Question 10b:

Please send also a revised budget plan which supports a launch date of the last quarter of 2018 for EM-1.

Answer 10b:

The announcement that EM-1 would be delayed beyond the last quarter of 2018 was due to technical, not funding challenges, and a different funding profile would not enable a launch date in the last quarter of 2018.

Question 10c:

I also ask that you make available a briefing to Members and staff on the EUS, or exploration upper stage.

Answer 10c:

NASA will be happy to provide such a briefing.

Question 10d:

Did PDR (preliminary design review) occur for the EUS by the end of 2016?

Answer 10d:

The Exploration Upper Stage (EUS) passed its Preliminary Design Review (PDR) on January 19, 2017.

Question 11:

I think the work on habitats is important. However, I think this should be a competitive process and should not be allowed to start subsidizing capsule programs which are already receiving substantial funding from NASA. Can you elaborate a little on the development process?

Answer 11:

NASA is now working on the second phase of the Next Space Technologies for Exploration Partnerships (NextSTEP), a public-private partnership model that seeks commercial development of long-duration, deep space exploration capabilities – such as habitat capabilities – to support more extensive human spaceflight missions in cislunar space and beyond. A key component of the NextSTEP partnership model is that it provides an opportunity for NASA and industry to partner to develop capabilities that meet NASA human space exploration objectives while also supporting industry commercialization plans. NASA also requires corporate resources to be contributed towards the overall effort by the awardees, demonstrating their commitment toward developing potential commercial applications.

The habitat work is being accomplished in a multi-phased, competitive approach. In 2015, NASA competitively selected four industry partners to provide studies on architectures and concepts of operations for deep space habitation systems. In a follow-on competitive process, the four Phase 1 partners were selected again to continue to Phase 2, in addition to two new additional partners. Currently in Phase 2 of this effort, NASA is developing habitation system concepts and technologies from six U.S. companies with the goal of developing full-size cislunar habitat ground prototypes by 2018. These ground prototypes will allow NASA and the NextSTEP habitation partners to: 1) evaluate configurations and habitability attributes of the habitat, 2) assess how the various systems interact together and with other capabilities like propulsion modules and airlocks, and 3) provide platforms to test and ensure that the standards and common interfaces being considered are comprehensive and enable the intended interoperability. Each of these activities will contribute to validating the systems needed for more challenging human future deep space activities.

One goal of this public-private approach is to enable the United States to develop the deep space habitation capability at a lower cost than through a traditional cost-plus procurement approach. The fixed price NextSTEP Phase-2 contracts are incrementally funded with payments based on milestone achievements; the milestones mark substantive technical achievements that buy down or retire risks. Phase-2 partners involved in habitat work are required to contribute at least 30 percent of the overall development efforts through corporate resources.

The activities of these NextSTEP awards will inform the future acquisition and deployment approach for the next phase of flight systems for deep space including important aspects, such as standards and interfaces, module configurations, and options for deployment using SLS and Orion and commercial vehicles. A future flight systems acquisition will also use a competitive selection process open to U.S. industry. In addition to U.S. industry, NASA is in discussions on collaborative opportunities with our international partners to enable fully operational deep space habitation capability.

For more detailed information about NextSTEP, please access the website below:

https://www.nasa.gov/nextstep

Question 12:

My understanding is that much of the space Technology budget is taken up by SBIR awards. What account at NASA formerly accommodated those awards, and what is the difference in spending levels then as compared to now?

Answer 12:

Provided below is a comparison of funding levels for awards to budget by account over the past 10 years.

FY/Account	SBIR/STTR Budget	Budget (excludes Reimbursable)	% to budget
FY 2009 - CAS	$135.8	$3,030.6	4%
FY 2010 - CAS	$95.6	$3,126.1	3%
FY 2011 - SMD/CAS/OCT	$187.9	$8,053.5	2%
FY 2012 - STMD/CAS	$171.6	$3,551.4	5%
FY 2013 - STMD	$165.2	$614.5	27%
FY 2014 - STMD	$175.0	$576.0	30%
FY 2015 - STMD	$190.7	$600.3	32%
FY 2016 - STMD	$200.9	$686.4	29%
FY 2017 - STMD	$199.0	$686.5	29%
FY 2018 - STMD	$180.0	$678.6	27%

Question 13:

What is the total budget for the Deep Space Atomic Clock, and does it contribute to a Mars mission in terms of navigation?

Answer 13:

The DSAC Project Life Cycle Cost is $77.9M with a current cost-to-go of $3.1M (launch slip dependent).

DSAC is not yet baselined for a future Mars mission; however, ground-based atomic clocks are the cornerstone of spacecraft navigation for most deep space missions because of their use in forming precision two-way coherent Doppler and range measurements. DSAC will provide an equivalent precision for forming one-way radiometric tracking data and eliminate the need to 'turn the signal' around as is done with two-way tracking. DSAC will provide scalable, flexible asynchronous tracking operations. The DSN can support multiple downlinks on a single antenna but only one uplink signal may be supported at any given time. When multiple spacecraft are simultaneously in view of a DSN antenna such as at Mars or the Moon, they must share time utilizing the uplink signal, thus limiting the amount of two-way Doppler tracking data. For a spacecraft outfitted with DSAC, one-way downlink radiometric tracking on a Mars-supporting antenna could be available throughout the entirety of each spacecraft's visibility period at no tracking time cost to the other spacecraft in view of that antenna. The level of performance would be unprecedented in a space clock. By virtually eliminating spacecraft clock errors from the radiometric data, DSAC enables a shift to a more efficient, flexible, and extensible one-way tracking architecture that benefits navigation and radio science. It enables a shift towards a scalable, flexible one-way radiometric tracking architecture from today's more rigid two-way architecture. This has the potential to increase the quantity and quality of tracking data, and enable new ways of operating, doing science, and exploring with deep space missions.

Question 14:

You mention in your testimony the Green Propellant Infusion Mission. Do the planned commercial crew transport systems use hydrazine as part of their propulsion system?

Answer 14:

Yes, both commercial crew transportation systems use hydrazine for various propulsion systems.

Question 15:

When you add up the billions of dollars to support the space station, we are spending more now than we did to build and assemble the station. That is an enormous chunk of money out of a limited budget. What are you doing bring that figure down by hundreds of millions of dollars?

Answer 15:

As NASA has moved into Station's intensive utilization phase, we have become more cost-efficient in ISS operations and continue to look for further efficiencies. Ongoing activities to responsibly lower the Operations and Maintenance (O&M) cost of the ISS include changes to contracts to incentivize efficiency, lower overhead cost, and targeted enhancements in technology investments to reduce manpower-intensive processes. Transportation costs are the largest component of the ISS budget. Transportation costs were not part of the budget reported for ISS assembly. NASA is spending less today to support ISS than during its assembly phase. The last Space Shuttle flight supporting ISS assembly was in 2011. At that point in time, Shuttle was used for crew and cargo transportation to ISS. In FY 2010, the ISS budget was $2.3B and the Shuttle budget was $3.1B, for a total of $5.4B to support ISS. The FY 2018 President's budget request is $1.5B for ISS and $1.7B for Crew and Cargo, for a total of $3.2B to support ISS. Even if the development costs for Commercial Crew are added at $0.7B, a total of $3.9B would still be $1.5B less than what it cost to support ISS in FY 2010. Factoring in inflation, today's costs are less expensive by an amount in excess of $2 billion each year.

Question 16:

What is the latest GAO estimate of whether commercial crew launches to the space station can occur as early as 2018?

Answer 16:

The Government Accountability Office (GAO) released its report "NASA: Assessments of Major Projects" (GAO-17-303SP) in May of 2017. The Commercial Crew Program was featured in the report, and GAO's cost and schedule status summary for the program noted:

> "Both of the Commercial Crew Program's contractors have made progress developing their crew transportation systems, but have aggressive development schedules that are increasingly under pressure. The contractors were originally required to provide NASA all the evidence it needed to certify that their systems met its requirements by 2017. In February 2017, we reported neither Boeing nor SpaceX can meet their original certification dates and both now expect certification to be delayed until 2018 [as footnoted: GAO, *NASA Commercial Crew Program: Schedule Pressure Increases as Contractors Delay Key Events*, GAO-17-137 (Washington, D.C.: Feb. 16, 2017)]. Boeing has proposed moving its certification review out to the fourth quarter of 2018—at least 14 months later than initially planned. SpaceX has moved its certification review to the third quarter of 2018—at least 15 months later than initially planned."

Question 17a:

Has NASA received a report from the contractors regarding how many NASA FTE's and how many contractors FTE's are needed to keep the EUS on track for launch on EM-2?

Answer 17a:

The SLS vehicle to be used for Exploration Mission -2 (EM-2) is the Block 1B configuration. Block 1B includes not only the Exploration Upper Stage (EUS) but also other upgrades to SLS, including a new Universal Stage Adaptor, Payload Adaptor, EUS Engines, updates to the integrated avionics and software, as well as the systems engineering and integration and safety and mission assurance functions to design, analyze, and build the integrated configuration. There are also substantial modifications that need to be made to the Mobile Launcher, propellant infrastructure at Launch Pad 39B, and the Vehicle Assembly Building to enable the stacking, processing, and launch of the updated Block 1B. In FY 2017, NASA plans include a total of approximately 740 contractor work year equivalent (WYE) and civil servant full time equivalent (FTE) working across the three exploration programs on development activities related to preparing for the first flight of SLS Block 1B on EM-2.

Question 17b:

Is NASA ensuring that FTE's which, for lack of a better word, expire with the completion of SLS first stage work, are made available to Marshall for work on the EUS so that Marshall Space Flight Center does not have to reduce its government workforce on other programs in order to proceed with EUS ramped-up activity?

Answer 17b:

In developing the Orion, SLS, and Exploration Ground Systems, NASA is seeking to build a sustainable National capability for the long-term human exploration of space. NASA is keeping each element of the program – SLS, ground systems, and Orion – moving at its best possible speed toward the first integrated launch, optimizing each element effort's schedule while being aware of the overall plan. This is best achieved when each program is allowed to progress on its own schedule, rather than being linked too tightly to the others. When tasks related to EM-1 are completed on any of the three programs, the workforce can progress to EM-2.

Question 18:

The FY19 figure provided last year for SLS is non-functional. Please provide an updated budget plan figure for FY19 and FY20.

Answer 18:

Please see table below, which is based on the President's FY 2018 Budget Request (in $M):

	FY 2019 (notional)	**FY 2020 (notional)**
Space Launch System	**2,083.6**	**2,265.6**
Launch Vehicle Development	**2,032.7**	**2,189.9**
SLS Program Integration and Support	**50.9**	**75.6**

Question 19:

NASA should be commended for utilizing space-based observatories to provide the scientific community with multi-wavelength observations of astrophysical objects, from Infrared/visible through ultraviolet, through x-ray, up through the gamma-ray portions of the spectrum. Successful space-based missions that have helped establish U.S. leadership in space science include the High-Energy Astrophysical Observatories, Hubble Space Telescope, Spitzer Space Telescope, Compton Gamma-ray Observatory, Chandra X-Ray Observatory, and the Fermi Gamma-ray Space Telescope. These missions have provided invaluable data for understanding some of the most challenging puzzles in the universe, and have complemented important ground-based astronomical radio, optical, and, more recently, gravitational wave observations, often enabled by NSF-managed programs. The upcoming launch of the James Webb Space Telescope is much anticipated and will help continue to provide the science community with key space-based IR/visible observations for hopefully many years to come. What are NASA's plans to continue to provide space-based observations in the x-ray and gamma-ray portions of the spectrum following the useful lifetimes of Chandra and Fermi?

Answer 19:

NASA continues to conduct a broad range of missions to observe the universe across the electromagnetic spectrum. In particular, missions at high-energies (X-rays and gamma-rays) are helping us better understand phenomena of the Universe which would be invisible, or simply inaccessible, at other wavelengths. NASA's portfolio of high-energy missions includes missions in operation, development, and under study, each with unique capabilities.

To prepare for the next National Academy of Sciences Decadal Survey of Astronomy and Astrophysics, NASA is studying medium- and large-scale missions, including three concepts for missions at high energies: STROBE-X, AXIS, and Lynx. STROBE-X, an X-ray timing and spectroscopy probe, is a medium-size mission concept that would offer a sensitive wide-field monitor, both to act as a trigger for pointed observations of X-ray transients and also to provide high duty-cycle, high time-resolution, and high spectral-resolution monitoring of the variable X-ray sky with very high sensitivity. AXIS, a high spatial resolution X-ray probe, is a medium-size mission concept that would have similar or better angular resolution than Chandra and have ten times the counting rate for most sources, allowing the accomplishment of science objectives not possible with Chandra. Lynx, previously referred to as the X-ray Surveyor, is a large mission concept that would be the most powerful X-ray observatory ever built, with exquisite angular resolution, very large collecting area, and a sophisticated suite of instruments. It is designed to answer fundamental questions about the growth of black holes in the infant universe, as well as trace the large-scale structure of hot material in the cosmos. More information about these studies is available at https://science.nasa.gov/astrophysics/2020-decadal-survey-planning/ (note that medium mission concepts are also called Astrophysics Probes by the astrophysics community).

NASA will select future small missions using Astrophysics Explorers Announcements of Opportunity, and medium and large missions in response to the Decadal Survey.

In addition, on June 3, 2017, NASA launched the Neutron star Interior Composition ExploreR (NICER) mission to the International Space Station. NICER will study the emissions of neutron stars in the soft X-ray band with unprecedented temporal resolution to probe their interior structure, the origins of dynamic phenomena, and the mechanisms that underlie the most powerful cosmic particle accelerators known. NASA's Chandra X-ray Observatory and the ESA-led X-Ray Multi-Mirror (XMM)-Newton Mission continue to provide spectacular insights in the nature of black holes, clusters of galaxies, and cosmology with their high angular resolution and large effective area. The Fermi Gamma-ray Space Telescope provides access to the sky at the very highest energies, where it has uncovered new phenomena, such as a population of radio-quiet, gamma-ray bright pulsars and evidence of dark matter. NASA is also operating the Swift Gamma-ray Burst Explorer and the Nuclear Spectroscopic Telescope Array (NuSTAR), two medium-class, Principal Investigator-led Explorer (MIDEX) missions.

Under development is the Imaging X-Ray Polarimetry Explorer (IXPE) mission, planned for launch in 2020; IXPE is a newly-selected Small Explorer (SMEX) mission that will expand our X-ray view of the universe by measuring the polarization of cosmic X-rays for the first time in objects such microquasars, supermassive black holes, and magnetars. NASA is planning to resume our partnership with the Japanese Aerospace Exploration Agency (JAXA) by supplying a soft X-ray spectrometer for the X-ray Astronomy Recovery Mission (XARM) which will recover the science of the Hitomi mission, lost shortly after its launch in 2016. NASA is also in discussions with the European Space Agency (ESA) to define contributions from NASA to the Athena mission, which would use a large X-ray telescope and a large-format microcalorimeter to study black holes and galactic structures with improved sensitivity and to obtain exquisite precision on measurements of spectral lines.

The Honorable Robert Aderholt
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Material for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Material for the record by Congressman Aderholt regarding Contract Funding-Propulsion

Question:

Does NASA have a plan yet for focusing on those contracts, on work related to propulsion, or are the funds being broken up and used for nuclear work not related to propulsion?

Answer:

NASA is funding Nuclear Thermal Propulsion (NTP) within the Game Changing Development program. This project is completing year 2 of a 3 year risk reduction activity, which focuses on developing low enriched uranium (LEU) fuel elements, reactor design, and engine design including cost and schedule estimates. This effort is critical to establish the technical and programmatic viability of developing a NTP system based on a LEU fueled reactor. Below is the status of project's milestones and deliverables. Consistent with the NASA FY 2017 Operating Plan and in working toward meeting the Explanatory Statement to Consolidated Appropriations Act of 2017, NASA has expanded this effort to include augmented and/or extended milestones and deliverables. Augmented efforts are indicated with blue highlighted text.

Table 1. Nuclear Thermal Propulsion project deliverables and controlled milestones (updated)

Deliverable & Controlled Milestones	Baseline Completion Date
FY 2016	
Engine architecture recommendation and rationale	09/2016 - completed
Initial LEU-based nuclear thermal propulsion system cost analysis report	09/2016 - completed
Engine Architecture Review*	09/2016 - completed
FY 2017	
1.0 mg of tungsten purified to at least 50%	05/2017 (TBD)**
Engine performance and feasibility analysis	06/2017 - completed
Surrogate cermet fuel element suitable for testing	06/2017 - completed
Updated LEU-based nuclear thermal propulsion system cost analysis	09/2017
Continuation review to down-select fuel elements	09/2017
Testing of surrogate CERMET FE in CFEET*	09/2017
Mid-term review for CFM assessment of NTP Mars transportation architecture	09/2017
50.0 mg of tungsten purified to at least 70%*	12/2017 (TBD)**
FY 2018	

Final LEU-based nuclear thermal propulsion system cost analysis	09/2018
Testing of depleted uranium cermet fuel element in NTREES/CFEET*	09/2018
1.0 kg of tungsten purified to at least 90%*	09/2018 (TBD)**
20W-20K cryocooler characterization and endurance testing complete *	**09/2018**
NTP Concept Review	**9/2018**

Key deliverables and controlled milestones (*) that support this initial three-year investment are identified in Table 1. Progress will be tracked through key and controlled milestones as well as deliverables.

** Will be updated pending a performance review of the contractor's progress

The Honorable Martha Roby
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Questions for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Question 1:

Administrator Lightfoot, in the question and answer portion of your testimony before the Subcommittee today, I asked you about NASA plans and timing for both the Nuclear Thermal Propulsion (NTP) and Additive Manufacturing programs as well as how NASA intends to allocate FY 2017 funding Congress appropriated in the recent Consolidated Appropriations Act.

My colleague, Chairman Aderholt, also asked you about the NTP program and its funding and time.

In both incidences you indicated that NASA plans to allocate the entire $35 million for the NTP program and the $25 million for the Additive Manufacturing Program. In fact, in your response to my question on Additive Manufacturing you called the program a "game changer." I cannot agree with you more. Moreover, I also believe that NTP is also a game changer for our space exploration programs and am very pleased that NASA intends to allocate funding toward these programs appropriately.

You mentioned, however, that NASA intends to release its Operations Plan for FY 2017 funds to Congress shortly. In advance of that release, so that we can better determine that NASA is allocating funds in the most effective way to advance these and the overall goals of the Administration, can you further clarify to the Subcommittee and me how NASA intends to allocate funding across its various Centers?

Answer 1:

The Agency transmitted its Operating Plan to the Committee on **6/27/2017**.

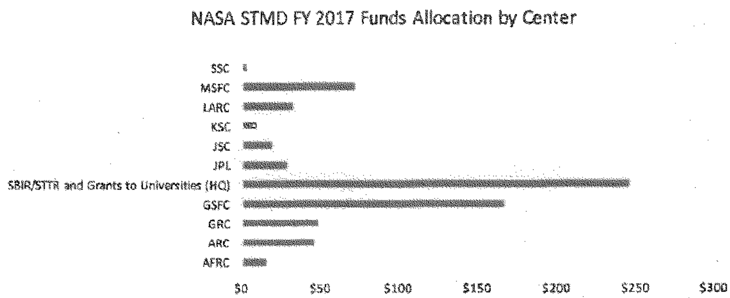
Total Nuclear Propulsion Systems investments in FY17: $35M

> **$19.2M,** Game Changing Development/Nuclear Thermal Propulsion. STMD initiated a 3-year NTP development activity in FY 2016, with the overall goal to determine the feasibility and affordability of a low-enriched uranium based engine system. Critical nuclear propulsion technologies being evaluated include (a) the viability of a low-enriched uranium system as a more affordable pathway to development of a nuclear rocket engine, and (b) the approach to maintaining long-term on-orbit storage of cryogenic hydrogen. NASA will evaluate the progress made on the initial three-year technology development effort. STMD's FY 2017 plan adds $12.3M (included in the $19.2M) to this effort above the Annualized CR or FY 2017 PBR funding level. The Nuclear Thermal Propulsion (NTP) project currently includes a ground demonstration of a Ceramic Metallic (Cermet) Fuel Element (FE) that will undergo non-nuclear thermal testing in a relevant environment with hydrogen flow through the cooling channels. This test will explore the feasibility of using a Cermet FE in a Low Enriched Uranium (LEU) NTP engine. Additional funding provided in FY 2017 will allow for alternate fuel/reactor conceptual design and analysis efforts; add cryogenic fluid

management activities including main propulsion system design and overall operations concepts; and also allow the subscale demonstration of the fully contained exhaust test concept at Stennis Space Center (SSC) for a NTP engine. The fully contained exhaust testing will seek to enable a safe and affordable way to test a LEU NTP engine. These demonstrations contribute to determining the overall feasibility of a LEU NTP engine and reduce the risk for proceeding with further ground demonstrations in the future.

- Additional efforts in STMD's FY 2017 plan are needed for a Nuclear Thermal Propulsion system:
    - **$10.2M** for propellant transfer and thermal management technologies (eCryo, GCD cryocooler and RRM3 added instrumentation to aid in critical modeling of cryogenic systems). These activities target enabling zero boil-off of cryogenic fluids in-space, with an ultimate goal of zero boil-off of liquid hydrogen, which is a critical technology development need for NTP.
    - **$3.0M** for Game Changing Development's kilopower activities that are relevant and needed for NTP. Kilopower is developing a compact, scalable fission power system for science and exploration missions. Kilopwer activities relevant to NTP include: uranium processing and manufacturing; BeO neutron reflector; reactor control systems; radiation tolerant instrument and control; CFD and finite element modeling; and integrated multi-physics nuclear codes.
    - **$2.6M** for SBIR/STTR awards made to NTP technologies

FY 2017 total STMD funds are allocated across the Centers as shown in the table below.



Question 2:

In the today's hearing, Chairman Culberson asked you about the Europa Mission and pointed out that the lander element of that mission is in statute. We are all excited about the Europa Lander mission and its potential to find life on another world so close to home.

As you know, the FY16 NASA CJS section of the Omnibus bill also mandated SLS was base-lined as the launch vehicle for the first Europa mission. NASA has been funded to develop that spacecraft. Which NASA Center is the Program Manager for the Europa Mission?

Answer 2:

The Planetary Missions Program Office (PMPO) at NASA's Marshall Space Flight Center (MSFC) manages the Solar System Exploration (SSE) Program, along with the Discovery and New Frontiers Programs. The Europa Clipper Project resides in the SSE Program; thus, the PMPO Program Manager has programmatic oversight of the Europa Clipper Project.

Currently, the Europa Lander is in the pre-Phase A stage of development (i.e., concept studies) and therefore, has not been officially assigned a program manager. Additionally, the President's FY18 Budget does not provide funding for a Europa lander, due to concerns that a lander mission would disrupt the balance in the Planetary Science program. However, if the mission is funded for continued development, the mission would likely be managed by PMPO given the Office's role.

Implementation responsibility for both the Europa Clipper Project and the pre-Phase A Europa Lander Study has been directed to NASA's Jet Propulsion Laboratory (JPL).

Question 3

Since the enactment FY16 bill, how much money has NASA invested in SLS to ensure the vehicle is ready for the Europa launch?

Answer 3:

The baseline scope of the SLS Program provides a capability for deep space access, which while being developed for Exploration objectives also serves to provide most of the capability necessary for the Europa Clipper mission. SLS has developed a publicly available Mission Planners Guide and is providing standard mission development support directly to the Europa Clipper team for early definition of joint requirements and interfaces in the broader context of mission and manifest planning. During the Europa formulation period, the Marshall Space Flight Center currently has no dedicated staff, but supports SLS/Clipper integration planning with approximately 2 FTE over the course of a year; likewise, the Jet Propulsion Laboratory currently has no dedicated staff, but supports SLS/Clipper integration planning with approximately 1.5 FTE over the course of a year. This support to date has been sufficient to allow necessary Europa Clipper mission planning without the expenditure of Europa-specific resources. NASA estimates that Europa-specific resource expenditure would need to commence approximately five years prior to launch. No specific funding has been spent to date to make sure that SLS can support Europa mission needs.

Question 4:

Besides the Europa mission, what other science or other cargo missions are planned to fly on SLS and when?

Answer 4:

In terms of the use of the Space Launch System (SLS) to fly science or cargo missions, beyond the Europa Clipper mission, the space science decadal surveys have not identified any science missions over the decadal timeframes that would require SLS. Nor have other agencies expressed any interest in using the SLS for cargo flights. Missions launched on the SLS in the 2020s will establish the capability to operate safely and productively in deep space. SLS can reduce trip times to outer planets and allow for larger mission mass.

Question 5:

Could you please comment on the difference in complexity and requirements between Orion crew safety requirements and approaches vs. Commercial Crew Program (CCP) crew safety requirements and approaches? Do the two programs share the same requirements in terms of mission success and crew safety? What types of missions are envisioned for Orion vs. Commercial Crew missions?

Answer 5:

The mission profiles to be flown by Orion will be very different from those flown by NASA's Commercial Crew Program providers' spacecraft, the SpaceX Crew Dragon and Boeing CST-100 Starliner. Orion is designed for deep space missions, while the Commercial Crew Program providers' spacecraft are being certified for low-Earth orbit (LEO) missions to the ISS. Deep space exploration systems must navigate a higher risk environment and mission profile than missions in LEO, higher re-entry velocities, and higher radiation environments as systems travel through Earth's radiation belts and beyond the protection of Earth's magnetic system. Missions to the ISS have to be certified for a longer duration mission (210 days) and a higher micrometeoroid environment. Thus, the two mission profiles are very distinct.

However, NASA uses the same or equivalent safety standards for deep space and LEO missions. NASA has worked carefully and diligently to assure our safety requirements span all mission phases and adequately address all credible hazards, including pad emergencies, in-flight aborts and emergency landings. Both Orion and CCP Programs implement applicable crew safety requirements in accordance with NASA Human Rating Requirements, NPR 8705.2B and are tailored to satisfy the technical requirements for human-rated-systems. Human-rating is an integral part of all program activities throughout the life cycle of the system, including design and development; test and verification; program management and control; flight readiness certification; mission operations; sustaining engineering; maintenance/upgrades; and disposal. Human-Rating Certification is the documented authorization granted by the NASA Administrator that allows the program manager to operate the space system within its prescribed parameters for its defined reference missions. Human-Rating Certification is obtained prior to the first crewed flight (for flight vehicles) or operational use (for other systems).

Generally speaking, NASA uses two Loss of Crew levels of safety for human spaceflight missions: thresholds and goals. The safety "threshold" is defined as a minimum tolerable/allowable level of crew safety. The safety "goal" is defined as the targeted level of crew safety. In the case of commercial crew missions, there is an additional level of safety – a Loss of Crew "requirement." A Loss of Crew safety requirement has been incorporated into the CCP contracts and it is more stringent than the safety threshold.

The three Loss of Crew safety levels for 210-day commercial crew missions to the ISS are:

1. Loss of Crew Threshold: 1:150
2. Loss of Crew Goal: 1:750
3. Loss of Crew Contractual Requirement: 1:270

Deep space exploration missions hundreds of thousands of miles from Earth bring an additional set of risks beyond those associated with regular ISS crew missions to LEO. These risks include higher spacecraft re-entry velocities, much greater radiation exposure associated with travel through and beyond Earth's magnetic system, etc. In recognition of these and other risks associated with deep space missions, NASA has levied a general LOC threshold for all crewed exploration missions (applicable to the entire mission, from launch through landing, covering both SLS and Orion) of 1:75. However, no two exploration missions are likely to be the same because each mission will be designed to enable increasingly ambitious missions in deep space, ultimately including crewed missions to Mars. Therefore, each exploration mission will have a specific risk profile related to the mission's unique combination of mission objectives, mission profile, and payload accommodations (including co-manifested payload) that, in combination with other exploration missions, will contribute to broader strategic exploration objectives.

Question 6:

Some commercial companies have plans to do "one off" missions to the Moon and to Mars, in some cases with NASA assistance and participation. Can you comment on these missions and contrast them to the approach of establishing long term infrastructure through SLS and Orion?

Answer 6:

NASA encourages commercial space activity, and is using public-private partnerships and commercial crew and cargo transportation contracts to promote the development of a robust space economy, beginning with low-Earth orbit (LEO). The Agency is also working to shape a future architecture for human space exploration to be sustainable and pioneering approaches by progressively expanding capabilities and distance with an objective of extending human presence into the solar system and to the surface of Mars. The Agency is developing a robust core set of evolving capabilities intended to ensure flexibility, affordability, and sustainability in the Nation's human spaceflight program, while using the International Space Station (ISS) and LEO as a research testbed for long-duration spaceflight. This approach provides NASA adequate adaptability to carry out increasingly complex missions to a range of destinations over time.

The U.S. aerospace industry, NASA's longtime partner in space exploration, appears to share NASA's vision of expanding human presence, and economic sphere, into space. Many of these commercial missions are complementary to, and can leverage off of, the SLS, Orion, and cislunar infrastructure being developed by NASA. The commercial lunar landers can be supported by astronauts in cislunar space via teleoperations and/or capturing lunar samples for return to Earth – benefitting both NASA and the commercial partners. The commercial Mars lander missions can provide valuable information to NASA on the potential use of Martian resources for future NASA Mars missions. These Mars missions may also leverage off the astronauts in cislunar space for Martian sample returns which must comply with stringent planetary protection protocols prior to being brought to Earth.

NASA cannot speak for the business plans of any particular commercial companies, but the public record suggests that while some companies may have plans for only limited missions to the Moon and Mars, others are aiming toward repeated missions and a long-term presence at these and other destinations in space. Some companies are already demonstrating – and others have announced – that their business models will include serving both NASA and non-NASA customers with activities in LEO, geosynchronous orbit, cislunar space (including the surface of the Moon), and beyond. To the extent that commercial companies can complement NASA's efforts to make space exploration more affordable and sustainable, NASA will continue to seek opportunities for synergy and cooperation. Similarly, it is NASA's goal to not compete with the private sector when such a capability or service exists. NASA is developing a flexible architecture/infrastructure that satisfies NASA exploration objectives while also having the ability of partnering with commercial companies, or procuring commercially provided services, on mutually beneficial missions and enabling emerging commercial market-based activities.

The Honorable Evan Jenkins
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Questions for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Question 1:

The ability to refuel satellites is critical to American commerce and national security. However, the Presidential Budget Request includes no funding for Restore-L and suggests transitioning the program to collaborate with DARPA. Since the DARPA satellite servicing activity occurs in geosynchronous orbit, and Restore-L is focused on an operational environment in low Earth orbit ("LEO"), is NASA in favor of abandoning LEO, the technologies developed through the program, and not providing a refueling capability to our nations' invaluable assets located there?

Answer 1:

The differences between operating in LEO and geosynchronous orbit are well understood and it is not necessary to conduct satellite servicing missions in both environments to demonstrate satellite servicing as a concept. NASA is considering alternative technical approaches to most effectively develop satellite servicing technology objectives through collaboration with industry and/or the Defense Advanced Research Projects Agency (DARPA) Robotic Servicing of Geosynchronous Satellites (RSGS) program. The development of these plans and discussions are on-going. The President's FY 2018 Budget Blueprint "restructures a duplicative robotic satellite refueling demonstration mission to reduce cost and better position it to support a nascent commercial satellite servicing industry, resulting in a savings of $88M from the 2017 annualized CR level." The final President's FY 2018 budget request includes $45.3M per year for satellite servicing starting in FY 2018. While NASA is still defining specific deliverables and milestones for the restructured satellite servicing project, NASA will aim to advance technology that will enable an emerging commercial satellite servicing industry as well as applications for future human exploration needs, such as the Orion capsule, and future science missions. .

Question 2:

There are concerns that China and Russia are developing a range of weapons that could disable U.S. satellites in low Earth orbit. It is important to quickly develop satellite servicing capabilities in both LEO and geosynchronous orbits. What funding resources are required for NASA to continue developing the Restore-L program and ensure that satellite servicing is a proven technology in the near future?

Answer 2:

The President's FY 2018 budget request adequately funds satellite servicing at a sustainable $45.3M per year. Near-term application of Satellite Servicing technologies is likely to be in the commercial sector. Thus, NASA will seek to partner with industry and other government agencies such as DARPA, who are also developing technology in this arena, to maximize resources and minimize duplication. Partnerships will also lead to broader applicability across industry sectors.

The Honorable José E. Serrano
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Questions for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Question 1:

Will President Trump's fiscal year 2018 request impact how NASA implements the funding appropriated for fiscal year 2017? Will NASA seek to prevent, inhibit, or slowdown in any way the fiscal year 2017 funding obligations in programs, projects, or activities for which President Trump has requested reductions or eliminations for fiscal year 2018? What guidance has NASA issued to its offices and directorates on this subject?

Answer 1:

No, consistent with the FY 2017 Consolidated Appropriations Act (P.L. 115-31), Mission Directorates will implement projects and execute funding in accordance with the agreed upon FY 2017 Operating Plan. Consistent with FY 2017 direction, formulation of ARRM is discontinued; however, where relevant, certain ARRM technologies will be evaluated and possibly utilized in future capabilities. With regard to terminations proposed as part of the FY 2018 budget request, NASA will take no action to terminate or slow down programs without prior notification.

Question 2:

How much funding has NASA obligated for outside contracts since January 20, 2017?

Answer 2:

Since January 20, NASA has obligated $7,737,211,650.90 for outside contracts.

Question 3:

Since January 20, 2017, to what extent has NASA relied on outside contracts that were not fully and openly competed?

Answer 3:

Since January 20, 2017, NASA has obligated $2,502,378,882.62 on outside contracts that were not fully and openly competed. All of the contract actions included in this total are due to one of the following reasons, consistent with 10 U.S.C. 2304(c) and the Federal Acquisition Regulation (FAR) Subpart 6.3:

(1) Only one Responsible Source and No Other Supplies or Services will Satisfy Agency Requirements.
(2) Unusual and Compelling Urgency.
(3) Industrial Mobilization; Engineering, Developmental, or Research Capability; or Expert Services.

(4) International Agreement.
(5) Authorized or Required by Statute.
(6) National Security.
(7) Public Interest.

Question 4:

For the period of time beginning January 20, 2017, please provide a listing of all of NASA's outside contract obligations of $50,000 or more, along with the purpose of each contract. In the listing, please indicate which contracts were not fully and openly competed.

Answer 4:

Please see attached Table 1.

[Clerk's note. — The answer to Ranking Member Serrano's question #4 Table 1 is available in digital format in the CJS Subcommittee.]

Question 5:

How many contract employees now work in office space with civil service employees of NASA?

Answer 5:

Approximately 29,000 on-site contractors are housed in NASA office space, including ~4,700 at the Jet Propulsion Laboratory, a Federally Funded Research and Development Center managed for NASA by Caltech.

Question 6:

Please provide a list of how many contract and civil service employees now work in each major location (i.e., locations with more than 100 total employees) staffed and maintained by NASA

Answer 6:

See table below.

Workforce by Installation - Current Estimate	Civil Service Employees*	Contractors**
Ames Research Center	1,177	1,400
Armstrong Flight Research Center	560	569
Glenn Research Center	1,602	1,626
Goddard Space Flight Center	2,908	5,394
Independent Verification and Validation Facility	46	171
Wallops Flight Facility	296	528
Johnson Space Center	3,110	6,792
Kennedy Space Center	2,017	3,962
Langley Research Center	1,834	1,625
Marshall Space Flight Center	2,292	4,117
Stennis Space Center	302	912
Headquarters (Includes OIG)	1,297	805
NASA Shared Services Center	144	468
Jet Propulsion Laboratory		4,728
Total	**17,585**	**33,097**

*Includes all employees including Pathways Interns and employees on extended leave.

**Includes on- and near-site contractors. This number is a Work Year Equivalent

Question 7a:

I am interested in the diversity of NASA staff. What efforts are you making to improve that diversity? Please specify the steps NASA is taking to recruit, hire, and retain an inclusive and diverse workforce, pursuant to the plans specified in NASA's January 2017 report, "NASA Model Equal Employment Opportunity (EEO) Agency Plan: FY 17-19 and FY 16 EEO Program Accomplishment Report."

Answer 7a:

NASA has sought to increase the diversity of its workforce and the inclusiveness of its workplaces across the United States through a number of efforts over the past decade. These efforts have been guided by the Agency's "Model Equal Employment Opportunity (EEO) Agency Plan" (pursuant to EEOC's Management Directive (MD) 715) (MD 715 Plan) and, more recently, the NASA "Diversity and Inclusion Strategic Implementation Plan" (D&I Plan). These plans have focused efforts on hiring practices, outreach and recruitment, employee advancement, and mentoring, among other initiatives.

Actions taken to help recruit, hire and retain a diverse and inclusive workforce at NASA have focused on targeted outreach and recruitment to attract a more diverse pool of candidates at the early career levels. For example, NASA's FY 2017-2019 MD 715 Plan contains specific actions aimed at developing a comprehensive outreach and recruitment framework that will ensure better coordination among NASA Centers and greater accountability. Led by the Agency's Office of Human Capital Management, this initiative is designed to ensure that NASA is casting a wide net when conducting its outreach and recruitment efforts. To bolster such efforts, the NASA's Office of Diversity and Equal Opportunity (ODEO) ensures annual NASA representation at the conferences of professional associations such as the Society of Women Engineers, American Indian Science and Engineering Society, Society of Asian Scientists and Engineers, Society of Hispanic Professional Engineers, National Society of Black Engineers, and Society for Advancement of Chicanos/Hispanics and Native Americans in Science. Currently, the two offices are partnering on an effort to enhance and improve the diversity return on investment from attendance at conferences and other recruitment events. For example, the Agency is developing a database of names and contact information of individuals who interface with NASA at the events. The database will enable NASA to forward vacancy announcements to participants at these conferences, dramatically enhancing NASA's ability to measure its return on investment from targeted outreach and recruiting efforts.

To address diversity needs at higher levels, e.g., GS 14, 15 and SES, NASA continually monitors data on hiring patterns, promotions, separations, awards, and other human capital processes to ensure that such processes are equitable. NASA's Center Equal Opportunity offices work with Human Capital Offices, hiring officials, managers, and supervisors to provide oversight and guidance in order to prevent workplace discrimination. In addition, NASA's FY 2016-2019 D&I Plan includes actions aimed at promoting a strong and effective mentoring program to enable employee engagement and effective communication. Such actions will enhance employees' work life and encourage career development. A further strategy is to offer career enhancing leadership assignments to employees to ensure diverse and inclusive leadership opportunities across NASA. In addition, ODEO is embarking on a suite of "just in time" education and awareness opportunities to give managers and supervisors refresher training on such topics as implicit bias at those junctures at which hiring, promotions, and awards decisions are made.

Beyond addressing current diversity workforce needs, NASA has several programs in place to provide outreach and education to the American public, especially the next generation of explorers. The D&I Plan includes several actions aimed at expanding education and outreach with under-represented educational communities to foster early talent detection in K-12 students and engage students from previously unexplored schools. For example, the plan calls for each NASA Center to foster early talent detection through the adoption of local K-12 schools where there is a diverse student population.

For additional information on NASA strategies to address workforce diversity we invite you to review the document "Promising Practices for Equal Opportunity, Diversity and Inclusion" (accessible at https://odeo.hq.nasa.gov/documents/PromPract_8-20-15_TAGGED.pdf)

Question 7b:

In addition, please provide for the record the diversity breakdown of the civil service employees and support staff in NASA by race and gender, in total and separated by job title, seniority or pay scales as best may characterize the makeup of NASA's workforce.

Answer 7b:

See attached Tables 1 – 3, which provide current demographic data to further describe current employee diversity at NASA.

Tables 1 – 3 below provide current demographic data to further describe current employee diversity at NASA.

Table 1: Grade Levels of NASA Employees, by Race, Ethnicity, and Gender:

Grade Level	Asian Americans and Pacific Islanders	Blacks or African Americans	Hispanics or Latinos	Multiracial	American Indians and Native Alaskans	White	Not Specified	**Total (All Diversity)**	Male	Female	**Total (Both Genders)**
GS 03-06	40	58	61	3	5	243	1	**411**	232	179	**411**
GS 07	14	36	37	1	3	127	0	**218**	102	116	**218**
GS 08	1	25	9	0	1	51	0	**87**	8	79	**87**
GS 09	37	79	46	5	2	199	1	**369**	187	182	**369**
GS 10	2	11	0	2	0	19	0	**34**	12	22	**34**
GS 11	53	120	92	7	11	441	1	**725**	397	328	**725**
GS 12	78	295	122	5	21	938	0	**1,459**	783	676	**1,459**
GS 13	392	604	391	12	57	3,236	1	**4,693**	2,931	1,762	**4,693**
GS 14	331	439	320	10	48	3,313	1	**4,462**	3,100	1,362	**4,462**
GS 15	336	335	239	8	33	3,565	1	**4,517**	3,346	1,171	**4,517**
SES	19	38	18	1	4	331	0	**411**	296	115	**411**
SL or ST	12	2	6	0	2	140	0	**162**	136	26	**162**
ALL Other Pay Plans	0	1	1	0	0	33	2	**37**	27	10	**37**
All Grade Levels	**1,315**	**2,043**	**1,342**	**54**	**187**	**12,636**	**8**	**17,585**	**11,557**	**6,028**	**17,585**

NASA Data as of 6/10/2017
Note: Some categories have been collapsed to protect the privacy of the data

Table 2: Occupations of NASA Employees, by Race, Ethnicity, and Gender

Occ. Category	Asian Americans and Pacific Islanders	Blacks or African Americans	Hispanics or Latinos	Multiracial	American Indians and Native Alaskans	White	Not Specified	Total (All Diversity)	Male	Female	Total (Both Genders)
Science and Engineering (S&E)	986	688	790	18	95	8,571	5	**11,153**	8,590	2,563	**11,153**
Professional Administrative	268	1,167	438	29	77	3,327	3	**5,309**	2,265	3,044	**5,309**
Clerical	12	116	36	4	1	160	0	**329**	49	280	**329**
Technician	49	72	78	3	14	578	0	**794**	653	141	**794**
All Occupations	**1,315**	**2,043**	**1,342**	**54**	**187**	**12,636**	**8**	**17,585**	**11,557**	**6,028**	**17,585**

NASA Data as of 6/10/2017
Note: Occupational categories are shown in more detail in Table 3

Table 3: Race, Ethnicity, and Gender of NASA Employees by Detailed Occupational Categories

Race and Ethnicity	Gender	Science and Engineering (S&E) Positions					Professional Administrative Positions						Clerical	Tech-nician	All NASA Employees		% of Total
		AST Engrg	AST Phys. Sci	AST All Other*	Other Science & Engrg (Non AST)**	Life Sci ***	Human Res	Gen. Admin	Acctg & Budget	Bus & Industry	IT	All Other Prof. Admin					
Asian American and Pacific Islander	Male	658	61	18	16	3	5	33	23	13	10	17	5	35	M	897	
	Female	198	19	3	8	2	17	55	48	24	10	13	7	14	F	418	
	Total	**856**	**80**	**21**	**24**	**5**	**22**	**88**	**71**	**37**	**20**	**30**	**12**	**49**	**Total**	**1,315**	*7.5 %*
Black or African American	Male	424	17	4	13	1	27	88	50	65	37	65	12	56	M	859	
	Female	210	8	5	3	3	82	321	143	163	43	83	104	16	F	1,184	
	Total	**634**	**25**	**9**	**16**	**4**	**109**	**409**	**193**	**228**	**80**	**148**	**116**	**72**	**Total**	**2,043**	*11.6 %*
Hispanic or Latino	Male	548	32	3	6	2	13	68	32	33	23	26	9	63	M	858	
	Female	179	11	5	4	0	23	103	36	40	10	31	27	15	F	484	
	Total	**727**	**43**	**8**	**10**	**2**	**36**	**171**	**68**	**73**	**33**	**57**	**36**	**78**	**Total**	**1,342**	*7.6 %*
Multiracial	Male	11	0	0	0	0	2	3	0	3	0	2	1	3	M	25	
	Female	6	0	0	1	0	1	11	0	2	2	3	3	0	F	29	
	Total	**17**	**0**	**0**	**1**	**0**	**3**	**14**	**0**	**5**	**2**	**5**	**4**	**3**	**Total**	**54**	*0.3 %*
American Indian and Alaska Native	Male	69	1	1	1	1	0	12	4	3	4	16	0	10	M	122	
	Female	22	0	0	0	0	4	22	3	4	1	4	1	4	F	65	
	Total	**91**	**1**	**1**	**1**	**1**	**4**	**34**	**7**	**7**	**5**	**20**	**1**	**14**	**Total**	**187**	*1.1 %*
White	Male	5,868	582	117	93	38	51	510	149	235	177	465	22	486	M	8,793	
	Female	1,594	190	49	33	7	129	742	296	226	113	234	138	92	F	3,843	
	Total	**7,462**	**772**	**165**	**126**	**45**	**180**	**1,252**	**445**	**461**	**290**	**699**	**160**	**578**	**Total**	**12,635**	*71.9 %*
	Male	2	0	0	0	1	0	0	0	0	0	1	0	0	M	4	

Not Specified	Female	1	0	0	1	0	0	0	1	0	0	1	0	0	F	4	
	Total	3	0	0	1	1	0	0	1	0	0	2	0	0	*Total*	8	*0.05%*
ALL EMPLOYEES		*9,790*	*921*	*205*	*179*	*58*	*354*	*1,968*	*785*	*811*	*430*	*961*	*329*	*794*		*17,585*	
Percent of total		*55.7%*	*5.2%*	*1.2%*	*1.0%*	*0.3%*	*2.0%*	*11.2%*	*4.5%*	*4.6%*	*2.4%*	*5.5%*	*1.9%*	*4.5%*			
					All Science and Engineering:	*63.4%*					*All Professional Administrative:*	*30.2%*					

NASA Data as of 6/10/2017
Notes:
AST = Aerospace Technology
* AST All Other includes: Social Sciences, Biological Sciences, Mathematics, and Medical
** Non AST S&E positions include: Biological Sciences, Engineering, Physical Science, and Mathematics
*** S&E Life Sciences positions include: Social Sciences, General Administrative, Biological Sciences, Medical, and Veterinary Medicine

Question 8:

With regard to NASA's procurement and contracting, for the fiscal year for which the most recent statistics are available, please provide the Committee with information regarding the amount and percentage of NASA contracts with small and disadvantaged business enterprises, particularly women and minority-owned firms.

Answer 8:

See table below.

FY2016 NASA Prime Metrics	Actual $	Actual %
Total Eligible Dollars	$15,993,717,656	N/A
Small Business	$2,666,446,582	16.67%
Small Disadvantaged Business	$1,307,308,409	8.17%
Women-Owned Small Business	$647,981,573	4.05%

Question 9:

Please explain how NASA will work to ensure the integrity, scientific independence, and freedom from outside interference for NASA Earth Scientists.

Answer 9:

NASA is committed to sustaining an environment of scientific integrity, honest investigation, and freedom from political interference. Scientific integrity continues to be a very high priority for NASA, and is embedded in the rules and requirements that govern our professional behavior across all technical disciplines. Our policies in support of scientific integrity are robust and have been in place for many years.

These policies reinforce NASA's commitment to:

- ensuring that data and research used to support policy decisions undergo independent peer review by qualified experts.
- scientists participating in NASA peer reviews and NASA research, whether NASA civil servants or members of the external scientific community, following documented standards for conflicts of interest.
- facilitating the free flow of scientific and technological information, consistent with privacy and classification standards.
- facilitating open communication among scientists and engineers, between NASA staff and the technical community, and between NASA employees and the public.
- requiring the results of NASA-funded research, both internal and external, be made available to the scientific community and to the public at no cost to them.
- conveying to the public scientific and technological information that derives from its research and development activities.
- promoting and maximizing openness with the media and the American people.
- the integrity of its use of Federal advisory committees (FAC) tasked with giving scientific advice.
- encouraging presentation of research findings at professional meetings.
- encouraging publication of research findings in peer-reviewed, professional, or scholarly journals.

As an Agency we continually recommit ourselves to scientific integrity on a regular basis, by reviewing and renewing existing policies every five years. Additionally, we have augmented long-standing policies with newer complementary policies to foster honesty and transparency in communicating the science conducted by and used by the Agency. NASA is committed to continuously upholding, examining, and enhancing its policies to maintain the highest standard of scientific integrity in the future.

Question 10:

The Trump Administration is proposing to eliminate NASA's Office of Education, including NASA's Minority University Research and Education Program. As a result of this elimination, how many minority students will not be served and supported by this program, and how many institutions will not be served and supported by this program, compared to the fiscal year 2017 enacted funding level? In addition, please provide the numbers of students and institutions by category (if necessary, please use the most recent available data):

- Achieving Competence in Computing, Engineering and Space Science
- Curriculum Improvements Partnership Award for the Integration of Research
- Jenkins Pre-doctoral Fellowship Project
- Motivating Undergraduates in Science and Technology
- Minority University Research and Education Programs Small Projects
- NASA Innovations in Climate Education Project
- NASA Science and Technology Institute for Minority Institutions
- Tribal Colleges and University Project—Native American Internships
- Tribal Colleges and University Project—Summer Research Experience
- University Research Centers

Answer 10:

In FY 2016 (the most recent year for which we have complete data), the MUREP project supported approximately 450 institutions and 20,000 students. Detailed data by category is provided in the table below. Note that some institutions participate in multiple MUREP activities, but we do not have sufficiently detailed data in all categories to remove the duplication in the numbers below:

Submitted Program Name:	Program consolidated into the following Activity in Fiscal Year (FY) 2013:	FY2016 # of Institutions Served	FY2016 # of Students Served
Achieving Competence in Computing, Engineering and Space Science (ACCESS)	Program sunset in FY 2012	-	-
Curriculum Improvements Partnership Award for the Integration of Research (CIPAIR)	MUREP Community College Curriculum Improvement (MC3I)	16	63
Jenkins Pre-doctoral Fellowship Project	**MUREP Funded Fellowship** - Jenkins Graduate Fellowship Program (JGFP) Aeronautics Scholarship and Advanced STEM Training and Research Fellowships (AS&ASTAR)	28	36
Motivating Undergraduates in Science and Technology (MUST)	MUREP Funded Scholarship	37	37
Minority University Research and Education Programs (MUREP) Small Projects	MUREP STEM Engagement (MSE)	27	429
NASA Innovations in Climate Education Project (NICE)	NASA Earth Systems, Technology and Energy Education for MUREP (ESTEEM)	8	615
Tribal Colleges and University Project (TCUP) — Native American Internships Tribal Colleges and University Project (TCUP) — Summer Research Experience	MUREP for American Indian and Alaskan Native STEM Engagement (MAIANSE)	14	135
University Research Centers (URC) NASA Science and Technology Institute for Minority Institutions (NSTI)	MUREP Institutional Research Opportunity (MIRO)	46	2,715
The following additional activities have been developed:			
	MUREP Funded Educator Professional Development (EPD)	11	919
	MUREP Aerospace Academy	19	13,535
	MUREP Educator Institutes (MEI)	52	1,102
	MUREP Internships	72	126
	MUREP Other Opportunities (MOO)	14	268
	NASA Community College Aerospace Scholars (NCAS)	114	461
	TOTALS	**458**	**20,441**

Question 11:

The Trump Administration is proposing to eliminate NASA's National Space Grant program. As a result of this elimination, approximately how many students will not be served and supported by this program, compared to the fiscal year 2017 enacted funding level? If necessary, please use the most recent available data.

Answer 11:

In FY 2015 (the most recent year for which we have complete data), the Space Grant project served approximately 334,000 students.

Question 12:

The Trump Administration is proposing to eliminate NASA's Established Program to Stimulate Competitive Research (EPSCOR) program. As a result of this elimination, how many states and approximately how many academic institutions will not be served and supported by this program, compared to the fiscal year 2017 enacted funding level? If necessary, please use the most recent available data.

Answer 12:

In FY 2017, NASA's EPSCoR project is supporting 25 states and 3 territories. The EPSCoR jurisdictions supported approximately 213 universities in FY 2016 (the most recent year for which we have data).

Question 13:

To what extent would elimination of the Plankton, Aerosol, cloud, Ocean Ecosystem (PACE) project lessen the nation's ability to deploy more advanced warning systems for harmful algal blooms, compared to current capabilities?

Answer 13:

The PACE mission would have focused on basic and applied research associated with harmful algal blooms (HABs), not real-time warning systems. NOAA is the lead on conducting and funding the development of HAB forecasts in collaboration with academic, state, and local manager partners.

The existing, long-term, on-orbit U.S. instruments (MODIS on Aqua, VIIRS on Suomi-NPP) provide some information on blooming algae, but do not have the capability to determine the presence of a specific harmful algal bloom.

The PACE mission would have: 1) helped to detect HABs and reveal HAB causes and impacts (economic, cultural, environmental, human health), 2) used observations from space to enhance monitoring of the coastal, Great Lakes, and inland waters, and 3) facilitated integration of satellite data into ecological models for potentially better predictive capabilities.

Question 14:

To what extent would the elimination of PACE lessen the nation's ability to improve aviation safety through better detection of volcanic ash, compared to current capabilities?

Answer 14:

PACE aerosol measurements were not optimized for volcanic ash detection, with or without the polarimeter instrument data being considered during PACE formulation studies. PACE, a global Earth viewing mission, would not have been able to determine the vertical distribution of ash clouds, which are of particular importance for aircraft routing and presently provided by the on-orbit MISR instrument on the Terra satellite, CALIOP lidar on the CALIPSO satellite and CATS instrument on ISS. Each of these instruments, however, is limited in repeat viewing capability due to their orbit and limited viewing swath width; MISR making repeat measurements every 9 days at the equator, the CALIPSO orbit repeat rate of 16 days and CATS viewing capability on the ISS. The spatial resolution and coverage of the planned PACE mission would have continued the high quality time series of aerosol properties provided by the MODIS instruments on the NASA Terra and Aqua missions, which are not fully met by the VIIRS instrument on the NOAA-NASA Suomi-NPP mission.

Question 15:

To what extent would the elimination of PACE lessen the nation's ability to provide enhanced observations in support of commercial fisheries, air quality data, and the tracking of oil spills, compared to current capabilities?

Answer 15:

The PACE mission would have collected global, hyperspectral data regarding Earth's integrated ocean and atmosphere system.

Regarding fisheries, ocean color measurements from PACE would have provided greater spectral detail than are presently obtained from orbiting U.S. or partner missions measuring fisheries-related ocean properties. The increased PACE spectral detail would have provided greater ability, and filled existing knowledge gaps required, to more accurately determine and assess phytoplankton stocks, biodiversity, HABs, fisheries, coastal habitat health, water quality and pollution, marine hazards such as oil spills, plus species distribution of upper-ocean phytoplankton populations that form the basis of the marine food pyramid.

Regarding air quality degradations owing to aerosols, the aerosol polarimeter instrument being studied as a secondary portion of the PACE payload would not have had vertical resolution capabilities, and thus would have provided indirect air quality measurements. Such indirect measurements are presently being obtained by the wide-swath MODIS instruments on the NASA Terra and Aqua spacecraft. The spatial resolution and coverage of the planned PACE instruments would have continued the high quality time series of aerosol properties provided by the MODIS instruments on the NASA Terra and Aqua missions, which are not fully met by the VIIRS instrument on the NOAA-NASA Suomi-NPP mission. Narrow-swath measurements of the vertical distribution of aerosols from space are presently being made by the on-orbit CALIPSO and CATS (on ISS) instruments.

For measurement of oil spills, the PACE instrument would have had the capability, with ~1 km^2 resolution hyperspectral data and 1-2 day repeat times, to detect and measure oil spill extent on a global scale. Presently orbiting instruments such as the 15-30 m resolution ASTER instrument on the NASA Terra mission which has a higher spatial resolution than PACE but with a longer revisit time, provides key details on oil spill tracking. The planned 5-10 m resolution of the all-weather/cloud-penetrating NASA NISAR radar mission, planned to launch in late CY 2021, will provide a leap forward in oil spill detection and tracking.

Question 16:

To what extent would the elimination of OCO-3 lessen the nation's ability to benefit from more precise measurements of carbon dioxide in the atmosphere? In particular, to what extent would OCO-3's elimination prevent the nation from better understanding: (1) carbon dioxide sources, and processes that take carbon dioxide out of the atmosphere, and (2) whether natural sinks for carbon dioxide are keeping pace with emissions or slowing down?

Answer 16:

The existing on-orbit OCO-2 (Orbiting Carbon Observatory-2) measurements provide global, accurate, monitoring of atmospheric carbon dioxide levels for the benefit of the Nation. OCO-2 was a legacy mission endorsed by the NAS Decadal Survey (DS), while OCO-3 was not an explicit DS recommendation. The OCO-3 instrument was built as a flight spare for the OCO-2 instrument, as part of the OCO-2 project.

OCO-3 would have been used to improve the understanding of the exchanges of carbon dioxide between the surface (land and ocean) and the atmosphere. Utilizing the ISS's inclined orbit, it would have provided understanding of the important diurnal cycle of carbon dioxide. OCO-3 would have mapped as many as 100 different areas each day and leveraged the ISS orbit to collect data at different times of the day, thus providing information on the diurnal cycle that is not available from the sun-synchronous OCO-2 orbit.

Regarding understanding of carbon dioxide processes, sources and sinks, OCO-3 was designed to collect column-averaged carbon dioxide abundances (average concentration from the surface to the top of the troposphere) over the sunlit portion of the planet from the northern boreal forest, to the equatorial region, to the Southern Ocean. The new observations would have spanned nearly all major agricultural regions and crop types. By virtue of the combination of the high spatial resolution and targeted mapping capability provided by OCO-3, it would have provided new measurements of the patterns of the sources of carbon dioxide from human activity in rapidly changing regions of the world such as the Middle East, India and China.

In addition to NASA's on-orbit OCO-2 and planned GeoCarb satellite missions, international space agencies also have carbon monitoring missions on-orbit and in development. JAXA, the Japanese space agency, launched GOSAT/Ibuki in early 2009, and a follow-on GOSAT-2 mission (in collaboration with the Japanese National Institute for Environmental Studies of the Ministry of Environment) is under development for launch in 2018. GOSAT and GOSAT-2 make similar measurements of carbon dioxide mixing ratios as does OCO-2; through the joint NASA-JAXA ACOS (Atmospheric CO_2 observations from Space) program, the agencies conduct collaborative validation field campaigns and algorithm refinement activities. In late December 2016, China launched the TanSat mission to make global measurements of atmospheric carbon dioxide concentrations from an orbit similar to that of OCO-2 in the A-Train. TanSat measurements are not yet available for use by the broad international research community. The French space agency (CNES) is developing the Microcarb mission to measure both CO_2 and methane with an emphasis on determining human-caused emission sources, using a small-satellite and miniaturized instruments. The French (CNES) – German (DLR) Merlin mission is under development for launch in 2019 to measure the greenhouse gas methane using an active lidar instrument.

Question 17:

Rockets tend to become reliable and safe through frequent launches. How would NASA ensure that the Space Launch System (SLS) becomes a reliable rocket, if SLS only launches once per year, at most, for the foreseeable future?

Answer 17:

SLS is being designed to be capable of supporting a long-term flight rate of one per year with a surge capability of up to three per year. The actual cadence of missions beyond 2022 will be defined in the coming months and years based on mission needs, available resources, and cost effectiveness. NASA has a rigorous, robust, and proven process, with independent authority oversight, for methodically assessing launch readiness. SLS systems and operations are being designed for a low flight rate. Procedural changes and design changes will be added to allow for a safe low flight rate.

Question 18:

Please specify the steps NASA is taking in response to GAO's most recent recommendations regarding the Space Launch System, Orion Multi-Purpose Crew Vehicle, and Exploration Ground Systems Development programs.

Answer 18:

The Government Accountability Office (GAO) released its report "NASA: Assessments of Major Projects" (GAO-17-303SP) in May of 2017. The Space Launch System (SLS), Orion crew vehicle, and Exploration Ground Systems (EGS) were featured in the report. The SLS program has made progress resolving its challenges, including determining the effects of long-term storage on new booster materials and developing software. The Orion program continues to manage the complex and challenging design, development, and testing of the Exploration Mission-1 (EM-1) components. In addition, EM-2 development has commenced with the initiation of machining of the primary crew module structure and the European Space Agency committing to produce a second service module. The program remains on track to meet its schedule baseline for EM-2 of no later than April 2023. In EGS, program is tracking schedule risks for the Mobile Launcher and the Ground Flight Application Software (GFAS) development effort. NASA is currently working to determine a revised launch date for EM-1.

GAO also released its report "NASA Human Space Exploration: Delay Likely for First Exploration Mission" (GAO-17-414) in March 2017. NASA concurred with the two report recommendations, both of which involved a reassessment of the NASA Exploration Mission 1 (EM-1) launch schedule. On June 23, 2017, NASA notified the Congress that the Agency was conducting a review of the EM-1 launch schedule consistent with the GAO's recommendations and would provide an updated EM-1 launch planning date once that assessment was completed in the September 2017 timeframe.

The Honorable Derek Kilmer
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Questions for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Question 1:

I'm aware of the impressive scientific experiments being conducted in suborbital space through NASA's Flight Opportunities Program in the Space Technology Mission Directorate. For example, researchers have the unique opportunity to test the impact of microgravity on fluids or fly ISS-bound technologies on risk reduction missions into suborbital space. Additionally, suborbital space vehicles such as Blue Origin's New Shepard and others offer an unprecedented opportunity for students to gain hands-on exposure to STEM and space at a low-cost. I wanted to hear your thoughts on NASA's ongoing commitment to programs such as Flight Opportunities and where suborbital space fits in NASA's strategic vision.

Answer 1:

As part of NASA's Science Technology Mission Directorate (STMD) portfolio, the Flight Opportunities program plays a critical role in helping cutting edge technologies advance their level of development so that they can be leveraged to help NASA meet its mission objectives. Over the history of the program, Flight Opportunities has provided access to relevant test environments (e.g., suborbital space), technical support, and specialized facilities that have enabled a wide variety of technologies to develop more quickly, with less risk and better results. As a result, that value of NASA's investment in these technologies has been realized faster and to a greater extent than would have been possible without Flight Opportunities.

In FY 2016, Flight Opportunities flew 23 technologies over the course of 4 parabolic, 3 high-altitude balloon and 2 commercial suborbital reusable launch vehicle test campaigns. In addition, NASA on-ramped Blue Origin through its commercial flight vendor solicitation to integrate and fly technology payloads on commercial suborbital reusable platforms.

Additionally, during FY 2016, Flight Opportunities awarded six collaborations to five different companies under the FY 2015 Announcement of Collaborative Opportunity (ACO). Through these awards Flight Opportunities encourages and assists the development of future commercial platforms. Also in FY 2016, Flight Opportunities released a small launch vehicle topic through the STMD Tipping Point solicitation. STMD competitively selected 6 public-private partnerships to advance new small launch vehicle capabilities to a point that industry would complete and qualify them for market without further government investments. In 2016 STMD issued another Announcement of Collaborative Opportunity (ACO) that included support for Small Launch Vehicle Technology Development to support the emergence of commercial small launch capabilities. Responses to the ACO are currently under review with selections tentatively scheduled for August 2017.

Twice a year, Flight Opportunities has been soliciting payloads for future flight suborbital flight campaigns through SpaceTech-REDDI solicitation. Through these calls a number of faculty, students and industry Principle Investigators have been provided opportunities to risk-reduce the development of their technology in a timely and relevant environment. For example, the program selected and funded 18 technology payloads in FY 2016 to be flown on multiple commercial flight platforms. In addition, the program seeks through internal calls technology payloads from other NASA programs. Flight Opportunities will continue to pursue public-private partnerships to develop small launch vehicle technology while supporting opportunities for technology development in suborbital space.

Flight Opportunities has been collaborating with other Mission Directorates to leverage scarce resources for accomplishing STMD/NASA mission. The program has worked with the Science Mission Directorate (SMD) to offer program-sponsored commercial flight platforms in their Undergraduate Students Instrument Project (USIP) solicitation as well as their Research Opportunities in Space and Earth Sciences (ROSES) solicitation. When NASA requires capabilities above and beyond offered by commercial suborbital flight providers, it utilizes the SMD suborbital program. This program provides opportunities for scientists to perform experiments on suborbital sounding rockets, balloons, aircraft, the International Space Station (ISS), commercial reusable suborbital platforms, and more recently, CubeSats. Experiments fall into three categories: 1) science and/or technology investigations; 2) state-of-the-art instrument technology development; and, 3) laboratory research. The suborbital program is critical for rapidly developing and testing new instruments that may eventually be part of larger SMD satellite missions, while also providing access to regions not otherwise accessible for unique in situ measurements. In addition, with their short lifecycle and hands on approach, SMD's suborbital programs are an essential training ground for the next generation of instrument scientists to experience a full lifecycle of a scientific space mission. The addition of CubeSats to the suborbital program extends this training ground into satellite development and operation, valuable skills that are extensible to more complex missions. The combination of unique science, advanced instrument and technology development, and cutting-edge training makes suborbital research a critical item for achieving NASA's science goals.

Question 2:

Finding cost-effective ways to improve propulsion and other critical capabilities in space is paramount to our Nation's leadership in space. I know that NASA is constantly exploring innovative technologies to help with this. How significant of a role is the high-powered solar electric propulsion technology to furthering and enhancing the Nation's deep space exploration program, the SLS/Orion, and relevant missions to deep space? Are you spending enough in FY17 and in the FY18 request to get a solar electric propulsion demo going by 2022, or whatever date is necessary for an early 2030s Mars mission? If the proposed elimination of the Asteroid Redirect Mission is realized, will NASA be able to run a full and open completion for said solar electric propulsion mission and execute on that mission in time?

Answer 2:

The high-power electric propulsion technology we are developing will enable larger and more capable science and exploration missions in cislunar and interplanetary space as well as enable more capable government and commercial missions in Earth orbit, including commercial communications, remote sensing, and more efficient delivery of spacecraft to higher orbits. It is a major step toward highly efficient, reusable in-space transportation systems. Almost any mission possible with the SLS/Orion could be made more capable with the addition of a solar electric propulsion stage.

Our plan and spending profile is adequate to prepare the solar electric propulsion system needed for a space demonstration beginning in the 2020 timeframe, well before 2022. STMD intends to also pursue a potential public-private partnership opportunity which might allow for an earlier space demonstration, assuming an appropriate cost-sharing partner can be found. That demonstration approach has the added benefit of promoting the early commercial infusion of this technology, as has already occurred with STMD's advanced solar array technology.

STMD will seek a cost-sharing partner to conduct the mission as described above. STMD is preparing a Request for Information to determine the likelihood of establishing such a partnership for a flight demonstration. If that does not occur, then the HEOMD Power and Propulsion Element may be the earliest flight of the new technology.

Question 3:

The President's Budget Request includes no funding for NASA's Restore-L mission to develop and demonstrate a satellite refueling capability in Low Earth Orbit. Instead, it calls for spending a small fraction of the previously planned funding on some technology demonstration work that might then be used by DARPA for a different program focused on Geosynchronous Orbit. The ability to extend a satellite's useful life is a valuable one; we have a large number of expensive government and private-sector satellites in Low Earth Orbit that would benefit. But this capability is unlikely to be developed without the kind of public-private partnership that Restore-L uses. When so many government and private-sector assets could be extended, why is NASA dropping this program? What will happen to the Landsat 7, which is the satellite that Restore-L is supposed to refuel?

Answer 3:

The President's FY 2018 Budget Blueprint restructures a duplicative robotic satellite refueling demonstration mission to reduce cost and better position it to support a nascent commercial satellite servicing industry, resulting in a savings of $88M from the 2017 annualized CR level. The President's FY 2018 budget request includes $45.3M per year for satellite servicing starting in FY 2018. Unlike the majority of Space Technology's demonstration missions, Restore-L is an entirely NASA-funded activity with no cost-sharing from outside stakeholders. Thus, Restore-L is not a public-private partnership. The new Satellite Servicing approach taken in the FY 2018 President's budget request will seek external partners (industry and other government agencies) to cost share in developing satellite servicing technologies and transfer them to industry. This will ensure technologies are being developed with broad applicability in mind.

The USGS is managing the Landsat system to ensure the continuity of this long-term land observation record. Using strategies to conserve fuel onboard the Landsat 7 mission, it is estimated that science data collection can be continued through mid-2021. Landsat-7 is being replaced by Landsat-9, which is projected to launch in 2023.

Question 4:

We've heard a lot about NASA's desire to enable the commercial industry by first focusing on the commercialization of Low Earth Orbit. I want to confirm that this sentiment still supports NASA partnering with the commercial sector for exploration of cislunar and beyond. The industry seems to be actively developing innovative cislunar and beyond capabilities such as habitats, settlement-enabling technologies, and in-space transportation systems.

Answer 4:

NASA's journey to deep space will include key partnerships with U.S. industry for the development of advanced exploration systems. The business models for these companies include NASA as a customer but are also predicated on the belief that there are other, non-Governmental activities that can be developed for low-Earth orbit (LEO), geosynchronous orbit, cislunar space (including the surface of the Moon), and beyond. These goals are complementary to NASA's goal of sustainable deep space exploration. Sustainable deep space exploration relies on broad participation by commercial enterprises in commercial and Government activities in space. In recognition of this, the Next Space Technologies for Exploration Partnerships (NextSTEP) is a public-private partnership model that seeks commercial development of long-duration, deep space exploration capabilities to support more extensive human spaceflight missions in cislunar space and beyond. A key component of the NextSTEP partnership model is that it provides an opportunity for NASA and industry to partner to develop capabilities that meet NASA human space exploration objectives while also supporting industry commercialization plans. As an example, many of the NASA requirements for long-duration deep space habitats are similar to the commercial requirements for a commercial habitat in LEO (e.g., highly reliable, reduced logistics). NextSTEP is supporting the commercial development of capabilities including in-space propulsion, habitation, in-space manufacturing, and small satellites.

The Agency is also supporting the development of commercial lunar exploration. In 2014, NASA introduced an initiative called Lunar CATALYST (Lunar Cargo Transportation and Landing by Soft Touchdown) and entered into competitively awarded partnerships with three U.S. firms to provide in-kind support to develop commercial lunar robotic landing capabilities. NASA is providing engineering expertise, hardware and software, and test facilities to these companies. The purpose of the initiative is to encourage the development of U.S. private-sector robotic lunar landers capable of successfully delivering payloads to the lunar surface using U.S. commercial launch capabilities. Initial flights of commercial lunar landers may begin as early as late 2017 or 2018, and as a result one or more of these companies will be able to market lunar payload delivery services for small instruments and technology demonstrations to NASA and other global commercial and government customers.

Question 5:

As you are well aware, the high cost of access to space makes it financially difficult – often impossible – for us to fully utilize and explore space. Asteroids have the capability to help us do this. They have the capability to unlock the solar system's economy.

What studies are being conducted to determine the value of the asteroid resources for exploration? Is in situ resource utilization being considered in any plans for Moon or Mars exploration activities?

Answer 5:

In-situ resource utilization (ISRU) – the capability to produce required resources at destinations rather than bringing everything from Earth – is a prime development focus at NASA. In addition to conducting various ground-based studies and technology development efforts, NASA will fly the Mars Oxygen ISRU Experiment (MOXIE) on the upcoming Mars 2020 rover mission to the surface of Mars. The MOXIE technology demonstration will produce oxygen (O_2) from the predominantly CO_2 Martian atmosphere. MOXIE is designed to generate 99 percent pure oxygen from the Martian atmosphere using solid-oxide electrolysis. The experiment will help determine if atmospheric ISRU is scalable to enable production rates required for human exploration and the manufacture of propellants. NASA has also done some early work on a potential lunar mission that could provide information about the volume and capture of water ice and other volatiles at the lunar poles.

NASA is also developing the Lunar Flashlight, Lunar IceCube, and LunaH-Map CubeSats that will be launched as secondary payloads on Exploration Mission-1 to map the distribution and abundance of lunar ice. The information gathered by these CubeSats will be used to fill gaps in our knowledge about the availability of lunar resources that could support future human exploration.

In addition, NASA has awarded several technology development efforts under the Small Business Innovation Research (SBIR) and Space Technology Mission Directorate (STMD) early stage investment activities. These include the following related to the understanding and potential utilization of asteroid materials.

2015 SBIR Phase I
In situ Resources Utilization
- **Deep Space Industries, Inc.**
  Task-Specific Asteroid Simulants for Ground Testing
- **Grainflow Dynamics, Inc.**
  Small Body Regolith Extraction System
- **Honeybee Robotics, Ltd.**
  Planetary Volatiles Extractor for In Situ Resource Utilization
- **ICS Associates, Inc.**
  Demonstration of "Optical Mining" For Excavation of Asteroids and Production of Mission Consumables
- **Pioneer Astronautics**
  Carbonaceous Asteroid Volatile Recovery (CAVoR) system
- **Space Resources Extraction Technology**
  Microwave Extraction of Water from Boreholes in Regolith

2015 SBIR Phase II
In situ Resources Utilization
- **Deep Space Industries, Inc.**
  Task-Specific Asteroid Simulants for Ground Testing
- **Honeybee Robotics, Ltd.**
  Planetary Volatiles Extractor for In-Situ Resource Utilization
- **Pioneer Astronautics**
  Carbonaceous Asteroid Volatile Recovery (CAVoR) system

2016 SBIR Phase I
In situ Resources Utilization
- **Pioneer Astronautics**
  Extraterrestrial Metals Processing
- **Deep Space Industries, Inc.**
  Extruded Clay-Based Regoliths for Construction on Mars, Phobos and NEAs

2016 SBIR Phase II
In situ Resources Utilization
- **Pioneer Astronautics**
  Extraterrestrial Metals Processing

2016 STTR Phase I
Regolith Resources Robotics
- **Intelligent Fiber Optic Systems Corporation**
  Robotic Tool for Asteroid Resource Prospecting and Characterization
- **Busek Company, Inc.**

AstroCube: An Asteroid Prospecting CubeSat Mission

- **Ascentech Enterprises, Inc.**
  Comprehensive Modeling for Off-Earth Mining Optimization and Resource Processing
- **Honeybee Robotics, Ltd.**
  Robotic ISRU Construction of Planetary Landing and Launch Pad

STMD Early Stage Investment Awards

- **Stanford University** - Asteroid Surface Resource Characterization Through Distributed Plasma Analysis of Meteoroid Impact Ejecta
- **West Virginia University** - Robotic In-Situ Surface Exploration System (RISES)
- **Missouri University of Science and Technology** - Laboratory Demonstration and Test of Solar Thermal Asteroid ISRU
- **University of Maryland** - Touchless Despinning of Asteroids and Comets via Neutral Beam Emitting Spacecraft
- **Kennedy Space Center** – Magnetic De-spinning of Space Objects
- **Kennedy Space Center** – Advanced Additive Manufacturing Feedstock from Molten Regolith Electrolysis

Beyond this, there have been studies conducted by the NASA Innovative Advanced Concepts (NIAC) on the topic of asteroid resource recovery. These studies are available at the links below:

NIAC Studies

- **Marc M. Cohen, Architect** – Robotic Asteroid Prospector (RAP) Staged from L-1: Start of the Deep Space Economy
- **Dr. Joel Sercel, TransAstra in partnership with ICS Associates, Inc.** – APIS (Asteroid Provided In-Situ Supplies): 100MT Of Water from a Single Falcon 9
- **Dr. Gary Hughes, California Polytechnic State University** - Molecular Composition Analysis of Distant Targets
- **Dr. Robert Hoyt, Tethers Unlimited** - WRANGLER: Capture and De-Spin of Asteroids and Space Debris
- **Jason Dunn, Made in Space, Inc.** – Reconstituting Asteroids into Mechanical Automata
- **Dr. Joel Sercel, TransAstra - Optical Mining of Asteroids, Moons, and Planets to Enable Sustainable Human Exploration and Space Industrialization** (study in progress)
- **Dr. Joel Sercel, TransAstra - Sutter: Breakthrough Telescope Innovation for Asteroid Survey Missions to Start a Gold Rush in Space** (study in progress)

The Honorable Derek Kilmer
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Material for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Material for the record by Congressman Kilmer regarding StemRad on Exploration Mission-1

Question:

Is it correct that during NASA's Exploration Mission-1, they will be testing a radiation vest from StemRad, which is an Israeli company?

Answer:

NASA has received a proposal from the German Aerospace Center (DLR) and the Israel Space Agency (ISA) to fly an experiment on NASA's Exploration Mission-1 (EM-1) testing a radiation vest from AstroRad, a joint venture between Lockheed Martin and an Israeli company, StemRad. The experiment consists of two anthropomorphic torsos with radiation sensors provided by DLR, and an AstroRad radiation vest provided by ISA. The payload has been approved by the Agency's Flight Planning Board and it is NASA's intent to fly the AstroRad payload in the Orion crew module on EM-1. NASA is in the early stages of working with DLR and ISA in developing agreements to finalize our plans.

The Honorable Matt Cartwright
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Questions for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Question 1:

The Administration's FY18 budget cuts the Plankton, Aerosol, Cloud and ocean Ecosystem (PACE) program, which aims to increase our understanding of our planet's oceans and how the oceans and our atmosphere interact, including how they exchange carbon emissions. Given that oceans are the main absorber of excess carbon dioxide in the atmosphere, it is vital that we understand this relationship and monitor our oceans. It is my understanding that PACE will also monitor clouds and aerosols—two of the major sources of uncertainty in current climate change projections, and would help monitor the health of economically important fisheries and harmful algae blooms, which release toxic substances that can kill marine life and harm humans.

Does the Administration think it is important to understand the health of our oceans and how they interact with our atmosphere? Do we not need to monitor our fisheries and know how our oceans and atmosphere exchange CO2? Does the Administration have plans for another way to monitor all of this?

Answer 1:

Overall, NASA makes numerous investments in support of ocean-related science as part of its interdisciplinary approach to Earth system science through its flight, research, applied sciences, and technology programs. The current Earth observation system contains spaceborne assets that provide some information regarding the health of our global oceans and fisheries and insight into air-sea interactions. The planned PACE mission would provide more information and fill knowledge gaps, and might have provided insight into ocean-atmosphere carbon exchange processes.

The existing, long-term, on-orbit U.S. instruments (MODIS on Aqua, VIIRS on Suomi-NPP), as well as the OLCI on the European Sentinel-3 (3A launched in February 2017, 3B scheduled for launch in 2017 or 2018), are currently providing ocean color measurements with accuracy, stability, and coverage that supports much scientific research. Importantly, the VIIRS and Sentinel-3 ocean color instruments are planned for flight on upcoming missions (in addition to those that are presently on-orbit) into the indefinite future. The required observational capabilities of MODIS on Aqua and VIIRS on Suomi NPP were not optimized for specialized observations of fisheries or ocean and atmosphere exchange of CO_2. The Landsat 8 OLI instrument is used primarily to map and monitor land and is being explored as a possible tool to examine the US coastal zones, but its 16-day repeat cycle offers limited value for routine coastal zone monitoring. Further understanding of the ocean and its role in weather and climate is derived from measurements from the on-orbit OSTM/Jason-2 and Jason-3 satellites, part of a U.S.-European series of satellite missions that measure the height of the ocean surface. As a follow-on, in 2020/2025 Sentinel-6A/B will provide continuity of sea surface height, ocean circulation and sea level measurements essential for operational ocean monitoring. NASA's Earth Science budget funds some *in situ* ocean sampling, as well as aircraft studies of specific events such as harmful algal blooms (HABs), and NASA supports the Harmful Algal Bloom and Hypoxia Control Act (HABHRCA- 1998), reauthorized in 2004 and 2014.

NASA has several competitive funding streams, including Research Opportunities in Earth and Space Science (ROSES) elements for Ocean Biology & Biogeochemistry (OBB), Physical Oceanography, and Ocean Salinity Science, among others, aimed at advancing understanding of Earth's aquatic environment and its role within the Earth system.

PACE would have been the first satellite mission to collect global, hyperspectral measurements of the Earth's integrated ocean and atmosphere system. PACE's ocean, Great Lakes, and other inland water observations would have provided high spectral resolution water-leaving reflectances ("ocean color") across the ultraviolet-visible-near infrared spectral region.

Question 2:

The Administration's proposed termination of its funding for the Deep Space Climate Observatory (DSCOVR) is concerning given that DSCOVR is already in space and operating. What is the rationale behind eliminating something that is already in space and operational? How much has already been spent on this program, and how does this compare to the cost of continuing to operate it? It is my understanding that DSCOVR tracks daily weather patterns and seasonal vegetation changes, monitors atmospheric pollution and makes the most precise measurements yet of how much energy Earth sends into space — crucial data for the improvement of our global climate models.

I also understand that previous estimates of the planet's energy balance relied on stitching together strips of data from orbiting satellites, but DSCOVR can observe the entire sunlit side of Earth and therefore provide more accurate estimates of the Earth's radiation. Is this accurate? The DSCOVR probe can also detect approaching solar storms - which pose a threat to astronauts, orbiting satellites and power grids on the ground. Such storms matter to U.S. Air Force, which I understand funded the satellite's launch, and the National Oceanic and Atmospheric Administration (NOAA), which operates the probe.

a. Were our Air Force and NOAA consulted regarding this proposed cut, was there any coordination or hand-off of the current NASA responsibilities?
b. How does NASA's elimination of its participation in this program affect NOAA and our nation's Air Force?

c. What data are we no longer going to be collecting if we terminate NASA's funding for this program?

d. After all the funds that have been devoted to launching and maintaining DSCOVR, and we already have data coming in, is the agency proposing to simply not use it now?

Answer 2:

The FY 2018 President's budget request calls only for an end of NASA activities related to research analysis of measurements from the DSCOVR Earth-observing EPIC and NISTAR instruments. NASA had no operational responsibilities related to EPIC and NISTAR measurements, nor were measurements from these instruments used in operational NOAA or U.S. Air Force forecasts/predictions.

It is the case that the vantage point and frequent sampling of the sunlit hemisphere of the Earth afforded by DSCOVR's location 1.5 million km from Earth add to similar data (such as cloudiness and cloud evolution, albedo, ozone, etc.) obtained by a suite of existing missions presently operating. However, information supplied by EPIC and NISTAR overlaps substantially with measurements from several other NASA instruments in low-Earth and geostationary orbit. EPIC complements (at lower spatial resolution) the measurements of MODIS and VIIRS; and NISTAR complements CERES for albedo and radiation balance.

The NASA-supplied Earth-observing instruments on NOAA's DSCOVR mission are secondary instruments relative to the primary objective of the mission as a sentinel for space weather measurements, which will continue and is supported elsewhere in the President's FY 2018 budget request.

a. **Were our Air Force and NOAA consulted regarding this proposed cut, was there any coordination or hand-off of the current NASA responsibilities?**

   As noted above, the NASA-supplied Earth-observing instruments on NOAA's DSCOVR mission are secondary instruments relative to the primary objective of the mission as a sentinel for space weather measurements, which will continue and is supported elsewhere in the President's FY 2018 budget request. The terminated NASA funding will impact only NASA research activities related to the scientific analysis of EPIC and NISTAR data. As such, there is no hand-off of responsibilities to discuss.

b. **How does NASA's elimination of its participation in this program affect NOAA and our nation's Air Force?**

   As noted above, the FY 2018 budget request only calls for an end of NASA activities related to research analysis of measurements from the DSCOVR Earth-observing EPIC and NISTAR instruments. NASA had no operational responsibilities related to EPIC and NISTAR measurements, nor were EPIC or NISTAR measurements used for operational NOAA or U.S. Air Force forecasts/predictions.

c. **What data are we no longer going to be collecting if we terminate NASA's funding for this program?**

   The DSCOVR spacecraft is operated by NOAA. At NOAA's discretion, data may continue to be acquired by the DSCOVR EPIC and/or NISTAR instruments and telemetered back to the ground, as is presently taking place routinely under NOAA control and with NOAA funding. The terminated NASA funding will impact only NASA research activities related to the scientific analysis of EPIC and NISTAR data.

d. **After all the funds that have been devoted to launching and maintaining DSCOVR, and we already have data coming in, is the agency proposing to simply not use it now?**

   The FY 2018 budget request provides funding to allow continuation of acquisition and operational NOAA and U.S. Air Force utilization of measurements from the DSCOVR satellite's primary space weather instrument suite, for the benefit and security of the nation.

Question 3:

What progress is NASA making on plans for completing the Mars Sample Return program? Specifically, when does NASA plan to refurbish orbital communications capabilities at Mars and what steps are being taken to develop the missions that will return the sample canisters collected by the Mars 2020 mission?

Answer 3:

While NASA currently has no commitment to a specific plan, schedule or budget for returning to Earth the Mars samples that will be collected and cached by the Mars 2020 Rover, the scientifically-selected samples are designed to be useful and valuable for a potential sample-return mission. NASA has been studying concepts for returning samples collected by the Mars 2020 rover and future telecommunication needs in the context of a larger Mars exploration architecture assessment, which was called for in the FY 2017 NASA Transition Authorization Act (PL 115-10). Consistent with the direction in the NASA Transition Authorization Act, this assessment would be conducted by the National Academies of Sciences, Engineering, and Medicine and will use the strategies and priorities described in the NRC Vision and Voyages for Planetary Science in the Decade 2013-2022 [the Planetary Science Decadal Survey] as a starting point. This assessment, which will consider opportunities for collaboration with commercial and international partners, will feed into the Administration's future Mars planning. This National Academies assessment is planned to be completed by Fall 2018.

Question 4:

The FY 2017 NASA Authorization Act provides funding for "an orbiter and a lander" at Europa. Given that NASA has taken on the Europa Clipper and the Mars 2020 mission, the need for further large class missions to accomplish Mars sample return, and the need for Discovery and New Frontiers missions, what impact would another large-class mission such as a Europa lander have on the PSD portfolio?

Answer 4:

Given that NASA's Planetary Science portfolio currently supports two large strategic missions in the five-year budget horizon (Mars 2020 and Europa Clipper), the Europa Lander mission was not included in the FY 2018 President's budget request since it could not be accommodated without significant impacts to other programs. If the Europa Lander is included within the Planetary Science budget at its current levels, significant reductions to all future competed missions and operating spacecraft would be required.

Question 5a:

What impacts have the cost and schedule issues with the Space Network Ground Segment Sustainment effort had on the improvements and maintenance of the rest of the Space Communications and Network division's portfolio, specifically the Deep Space Network?

Answer 5a:

The Space Network Ground Segment Sustainment (SGSS) project is a modernization effort critical to sustaining the Space Network (SN) and providing reliable services to SN customers. The delay in completing SGSS has added risk and costs to the operations of the SN. Space Communications and Navigation (SCaN) is working hard to complete SGSS while still addressing these risks. The other networks – the Near Earth Network (NEN) and Deep Space Network (DSN) – have not been impacted by these challenges.

The efforts to maintain and improve NASA's space communication networks continue as planned. The DSN's three Deep Space Communication Complexes are in the process of adding new antenna capabilities, with two 34-meter antennas recently built at the Canberra Deep Space Communication Complex, and two in work at the Madrid Deep Space Communications Complex. The NEN recently added a 10-meter antenna. Finally, the SN's space segment, the Tracking and Data Relay Satellite (TDRS) System, is scheduled to launch its final third generation TDRS (TDRS-M) in August 2017 from the Kennedy Space Center, with a lifetime expectancy of 15 years. All scheduled maintenance continues as planned. Proficiency values (actual service provided vs. what was scheduled) for all three networks have remained outstanding, with the DSN at 98.6 percent in FY 2016, the NEN above 99.5 percent, and the SN at 99.96 percent.

Question 5b:

How has NASA continued to address the effects of budget reductions to the DSN identified in the 2015 NASA OIG report, "NASA's Management of the Deep Space Network?"

Answer 5b:

SCaN is managing the DSN closely and continues to make maintaining it at the highest level a top priority; there has been no impact to operations and maintenance of the DSN. The addition of new technologies for the networks, including optical communications, has been pushed to the right due to the priority of maintaining the networks. NASA's DSN Aperture Enhancement Project (DAEP) modernizes and upgrades the DSN's ground stations to enhance capacity, improve flexibility to support customer missions and reduce operations and maintenance costs. The existing DSN 70-meter antennas are increasingly in need of substantial maintenance and repairs, and are approaching the end of their operational lifecycles. New 34-meter antennas will be easier and more cost-effective to maintain, in addition to providing the same or better performance as the 70-meter antennas. DAEP will improve the reliability of the DSN and increase the resiliency for mission support in the northern hemisphere. The DAEP allows missions, both robotic and human, to uplink and downlink larger amounts of science and telemetry, tracking, and command data back and forth to Earth. The work anticipates for additional mission loading from projects in development; and is part of a recommended solution to provide additional assets on a routine basis by 2020. NASA's planning for the DAEP continues to take into consideration realistic savings from ongoing efficiency measures.

The Honorable Matthew Cartwright
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
Material for the Record
Hearing regarding FY 2018 Budget Request
National Aeronautics and Space Administration

Material for the record Mr. Cartwright regarding NASA EPSCoR Program

Question:

Cartwright: Can you speak to how the closeout of NASA EPSCoR being coordinated with other agencies will be effected, other agencies that have EPSCoR programs?

Lighfoot: I would probably have to take that one and bring you guys back that, if that is okay, because I am not sure I know that off the top of my head in terms of exactly how they impact. I know we are coordinating with them. That is why we got the money in 2018 to do that, but the exact coordination, I would rather bring that back, if that is okay

Answer:

Should Congress support the proposal to eliminate the EPSCoR project, NASA EPSCoR would coordinate closeout activities through the EPSCoR Interagency Coordinating Committee (EICC). Among other activities, coordination would be required to accommodate changes to proposal peer review protocol, support for EPSCoR national meetings, and jointly-funded research projects. Note that no closeout activities will be implemented until Congress provides that direction.

WITNESSES