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CLIMATE CHANGE RESEARCH AND SCIENTIFIC INTEGRITY

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

FEBRUARY 7, 2007

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

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CLIMATE CHANGE RESEARCH AND SCIENTIFIC INTEGRITY

WEDNESDAY, FEBRUARY 7, 2007

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 10:08 a.m. in room SR–253, Russell Senate Office Building. Hon. Daniel K. Inouye, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. DANIEL K. INOUYE, U.S. SENATOR FROM HAWAII

The CHAIRMAN. I apologize for my delay, believe it or not, I was stuck in the elevator.

Over the course of this Congress, the Commerce Committee will pursue legislation to strengthen the Federal climate research program. We owe it to our constituents and future generations to support the fundamental science needed to fully understand the impact of climate change.

However, before we can even begin to debate climate change, we must investigate the numerous allegations that our Federal scientists are being constrained from conveying their research findings and conclusions. Such allegations are very serious.

We, in Congress, as well as decisionmakers within the regulatory agencies must examine and weigh the scientific evidence to guide changes in policies, laws and regulations.

To make the best decisions, we need free access to unbiased scientific findings and conclusions, because the quality of our decisions is highly dependent upon the science we use to make those decisions.

To deny Federal scientists the right to speak, or to change the findings of their work, or to deny the release of their work, basically creating an atmosphere of intimidation and fear, is a great disservice to the public.

On January 30, 2007, the Union of Concerned Scientists issued a report called, "*Atmosphere of Pressure: Political Interference in Federal Climate Science.*" The report found and documented an alarming number of instances in which Federal scientists and employees were pressured to downplay the significance of their climate science work, or were prevented from sharing the results and conclusions with the public.

Today's hearing will examine these claims, which suggests that we have not always had unfettered access to climate change research data. Let me be clear to those who criticize this report,

claiming that the survey size is too small; one incidence of political tampering with science is too many.

Dr. Rowland, who appears today, shared the 1995 Nobel Prize in Chemistry for his work on the environmental effects of chlorofluorocarbons or CFCs. His work eventually led to the Montreal Protocol, an international treaty, which stopped the widespread use of CFCs and helped reverse the damage to the ozone layer.

Dr. Rowland serves as an example of the role that accurate, undistorted science can play in achieving sound policy.

With our witnesses, we'll discuss the extent to which government scientists are able to communicate their results and conclusions to Congress and the public and will make recommendations on how to increase scientific openness in all of the Federal agencies.

Of course, the communication of scientific information is just half of the story of science integrity. We also must fund appropriate research to ensure that climate science advances. So, we have another witness who will discuss the funding of climate research, including important satellite measurements.

We have much work ahead of us if we are to seriously address the issue of climate change.

We begin with the issue of scientific integrity as the foundation of that effort. So, I thank all of our witnesses for joining us today, and we're looking forward to a lively discussion. And may I now call upon the Vice Chairman of the Committee.

STATEMENT OF HON. TED STEVENS,
U.S. SENATOR FROM ALASKA

Senator STEVENS. Mr. Chairman, global climate change is a very serious problem for us, becoming more so every day. As far as the United States is concerned, the evidence of global climate change is more apparent in my home State of Alaska than anywhere else.

During my most recent trip to the West Coast of Alaska, I witnessed an incident where the fuel storage tank for the whole village of Kivalina nearly fell into the ocean due to severe winter storms and coastal erosion. The potential catastrophe was averted through emergency action taken by the U.S. Army Corps of Engineers, but over the past years we've seen many other changes in the Arctic besides severe coastal erosion.

The Arctic sea ice is receding, the trees are going further north, the permafrost is thawing, the impact of climate change is real, and we need to prepare for its effects, and to do this, we do need sound science.

I am concerned about the human impacts on our climate, and that's why I have introduced Senate Bill 183, the Improved Passenger Automobile Fuel Economy Act of 2007. Some think that's a strange thing, coming from me, but I believe it's essential that we raise the questions about how much of this effect is being caused by man, and how much of it is really a natural phenomenon?

This bill will require a fuel economy standard of 40 miles per gallon for passenger automobiles manufactured in the model year 2017. I believe we do have the technology-base to do that.

The transportation sector generates more than one-third of the Nation's greenhouse gas emissions, I believe we must demand im-

proved fuel economy from our vehicles, and this bill requires a voluntary national registry for the greenhouse gas trading credits. I am extremely alarmed by the information I'm getting about methane, and its release from areas like our permafrost in Alaska and in Russia.

We need to look at other possible causes of climate change. Over the past 100 years, the sun has radiated additional energy, which is responsible in part for the increase of global temperature changes. Researchers such as Dr. Syun Akasofu at our International Arctic Research Center in Alaska, found that the Atlantic and Pacific oscillations have been dumping warm ocean water in the Arctic Ocean. This has greatly contributed to the degradation of the Arctic sea ice.

In order to obtain a better understanding of these, and other factors, we need a robust climate science budget, and I support you in the concept that it should be totally non-partisan, and it should be a concept of validating what each researcher is asserting.

We have so many different assertions now as to what is causing climate change. Really, good scientist's conclusions are based on their own research, and their computer runs remind me of my first introduction to computers, and that is, you've got to be sure what goes in if you want to understand what comes out. Thank you.

The CHAIRMAN. Thank you very much.

Senator McCain?

STATEMENT OF HON. JOHN MCCAIN,
U.S. SENATOR FROM ARIZONA

Senator MCCAIN. Thank you, Mr. Chairman, and I thank you for holding this hearing. I would just like to briefly say that, for years we have been frustrated by the lack of recognition, much less cooperation, on the part of the Administration in addressing this issue. Required reports that I would ask be made part of the record have never been—that were required by law—have never been submitted by the Administration, and fortunately, hopefully, we have now turned a corner and that there is finally recognition that the debate is over.

Now, the question is, how do we accommodate, as a world, conditions that—to some degree—are irreversible, and how do we as a Congress and a Nation, take the required measures to reduce the emissions of greenhouse gases?

So, I thank you for holding this hearing, Mr. Chairman. I'd just like to—an example of the kind of—it was back in Fiscal Year 2002, Admiral Lautenbacher said, "The greenhouse gases are rising today, there's not anything you can do, short of everyone going to bed for the next 30 years, to stop them from rising. So, the object is to stop the growth of greenhouse gases."

This is the kind of attitude that, unfortunately we had from the Administration for many, many years, including the years that I had the honor of chairing this committee. I hope today, and in the future, we will turn the corner and get serious about addressing them.

And I thank you for holding this hearing, Mr. Chairman.

[The prepared statement of Senator McCain follows:]

PREPARED STATEMENT OF HON. JOHN MCCAIN, U.S. SENATOR FROM ARIZONA

Thank you Mr. Chairman for calling today's hearing. I applaud your efforts to continue with these committee hearings concerning one of the most challenging issues of our time, climate change.

As indicated by the Intergovernmental Panel on Climate Change's *Fourth Assessment Report Summary for Policymakers* which was issued last Friday, there is overwhelming scientific evidence that mankind is altering the world's climate system. The Report's assessment is yet another call for us to take this problem seriously and to immediately take actions to make significant reductions in our greenhouse gas emissions.

I am pleased that the Administration is represented here today to discuss this serious problem. I hope that we can have an open discussion on whether or not this Administration have sought to alter the work of or denied public access to many of our top scientists.

As I have traveled around the world, I have heard from many scientists of their concerns on this issue. As a result of some scientists coming forth publicly with their claims, the Administration has started the process of revising their policies to provide for greater openness of scientific research results. This problem must be corrected immediately. Otherwise, we risk losing the confidence of the American public and the broader research community regarding the quality and credibility of government-sponsored scientific research results.

Mr. Chairman, I also note the fact the other Senate Committees are also having hearings on climate change. I think this a good thing and will only serve to further educate the Members on this complex issue.

A couple of weeks ago, a coalition of major U.S.-based businesses, with a combined market capitalization of over $750 billion, joined with environmental organizations to call upon our Federal Government to quickly enact strong national legislation to achieve significant reductions of greenhouse gas emissions. The members of the U.S. Climate Action Partnership recognize that setting the ground rules now for managing greenhouse gasses will unleash American ingenuity in an all out effort to meet this complicated challenge.

In their letter to President Bush, the coalition said that, "*properly constructed policy can be economically sustainable, environmentally responsible, and politically achievable. Swift legislative action on our proposal would encourage innovation and provide needed U.S. leadership on this global challenge*." They further stated that "*. . . climate change will create more economic opportunities than risks for the U.S. economy*." I agree.

Senator Lieberman and I recently introduced our bill S. 280, the *Climate Stewardship and Innovation Act of 2007*. This legislation is based upon five guiding principles.

First, it must have rational, mandatory emission reduction targets and timetables. It must be goal oriented, and have both environmental and economic integrity. Let us realize that the climate system reacts not to emission intensity but to atmospheric concentration levels. We need policy that will produce necessary reductions, not merely check political boxes. The reductions must be feasible and based on sound science, and this is what we have tried to do in our bill. We realized that this problem is an environmental problem with significant economic implications and not an economic problem with significant environmental implications.

Second, it must utilize a market-based, economy-wide "cap and trade" system. It must limit greenhouse gas emissions and allow the trading of emission credits across the economy to drive enterprise, innovation and efficiency. This is the central component of our legislation. Voluntary efforts will not change the status quo, taxes are counterproductive, and markets are more dependable than regulators in effecting sustainable change.

Third, it must include mechanisms to minimize costs and work effectively with other markets. The "trade" part of "cap and trade" is such a mechanism, but it's clear it must be bolstered by other assurances that costs will be minimized. I am as concerned as anyone about the economic impacts associated with any climate change legislation. I know that many economists are developing increasingly sophisticated ways to project future costs of compliance. Lately, we have seen the increased interest in this area of research. As we learn more from these models about additional action items to further reduce costs, we intend to incorporate them. Already, based upon earlier economic analysis, we have added offset provisions in this bill in an effort to minimize costs and to provide for the creation of new markets. And, I assure my colleagues, we will continue to seek new and innovative ways to further minimize costs. Let me again mention what the coalition of CEO's of major U.S.-based companies and environmental groups said last week, "*In our view, the*

climate change challenge will create more economic opportunities than risks for the U.S. economy."

Fourth, it must spur the development and deployment of advanced technology. Nuclear, solar, and other alternative energy must be part of the equation and we need a dedicated national commitment to develop and bring to market the technologies of the future as a matter of good environmental and economic policy. There will be a growing global market for these technologies and the U.S. will benefit greatly from being competitive and capturing its share of these markets. Our legislation includes a comprehensive technology title that would go a long way toward meeting this goal. Unlike the Energy bill, it would be funded using the proceeds from the auctioning of allowable emission credits, rather than from the use of taxpayers' funds or appropriations that will never materialize.

And fifth, it must facilitate international efforts to solve the problem. Global warming is an international problem requiring an international effort. The United States has an obligation to lead. If we don't lead proactively, we will find ourselves following. There is no in between. However, our leadership cannot replace the need for action by countries such as India and China. We must spur and facilitate it. We have added provisions that would allow U.S. companies to enter into partnerships in developing countries for the purpose of conducting projects to achieve certified emission reductions, which may be traded on the international market.

These five components represent a serious challenge that will require a great deal of effort, the concentration of substantial intellectual power, and the continued efforts of our colleagues and those in the environmental, industrial, economic, and national security communities.

Again, I thank you for calling this hearing. I welcome our witnesses here today and look forward to their testimony.

The CHAIRMAN. Thank you very much, and I can assure you, we'll do our very best, sir.

Senator Kerry?

STATEMENT OF HON. JOHN F. KERRY, U.S. SENATOR FROM MASSACHUSETTS

Senator KERRY. Mr. Chairman, thank you very much. Thank you for holding this hearing. I thank Senator McCain, also, because he held some important hearings for a period of time as Chairman.

This is a very important beginning, Mr. Chairman. There are two great issues in our Congress right now, one is obviously a war that we're engaged in, in Iraq, and this. This is the other great issue.

It's hard sometimes, because of the draconian scenarios that the end-game draw for us all with respect to global climate change. It's hard for some people to wrap their hands around it and say, "Wow, this is really serious," or "We could do something about it."

The bottom line is, as you know, Mr. Chairman, we have no choice. We have to. I've been involved in this, since I got on the Commerce Committee. Senator Gore and I, and a few others held the first hearings on this back in 1987. We then became participants in the first inter-parliamentary conference, sometime around 1989–1990, I remember. Then we went down to Rio, and took part in the Earth Summit, and came up with an agreed-upon framework for voluntary reductions. But even then, in 1990, the science was there and people were accepting that we had to do something. In 1992, President George Herbert Walker Bush signed that Framework Agreement, and we ratified it.

Since then, the science has been growing. You've had the UN IPCC Report of 2001, which could not have been more clear. In fact, we've had 928 peer-reviewed studies, all of which confirm the human input to global climate change, to the warming, to the greenhouse gas effect, and all of us understand the basic science.

That, without the greenhouse effect, life wouldn't exist on Earth. We all understand that it's containing gases—and I'm not going to go through it all now, except to say that the science has been building on this.

As John Holdren at Wood's Hole in Harvard says, you know, the other side has a responsibility to show something to the contrary. There isn't one peer-reviewed study, not one, that suggests an alternative that scientists accept as to why the warming is taking place, and not one peer-reviewed study that tells us why there might be this warming outside of human-induced greenhouse gases.

So, what are we doing here? Now, scientists tell us there is a confirmed consensus that we have a 10-year window. Now, what happens if we're all wrong? Those of us who believe the science of 928 peer-reviewed reports, and of over 1,000–1,500 scientists, and over 600 who just gathered in Paris—what happens if we're wrong? And we embrace doing things about clean fuels and efficiency; and clean coal technology? The "Big Three" of what we have available to us. If we're wrong, we've got cleaner air, a healthier Nation, more jobs, better technology, and we've protected the environment.

What happens if they're wrong? Catastrophe. That's the ledger, here. Mr. Chairman, you know this is important because this Administration has been beyond irresponsible on this. Beyond irresponsible. In the face of all of this science, in the face of all of these reports, they're playing games, political games for money.

What they do is they take the science, and they tailor it to reflect their political goals. The interference is stunning—from deleting key words, deleting words, this is George Orwell at its best—deleting "warming climate," deleting "global climate change," deleting "climate change" from press releases, changing agency mission statements, de-emphasizing climate research, denying media access to prominent climate scientists. It's absolutely stunning, what's been going on. And it has to stop.

This is the right place to begin, Mr. Chairman, looking at what has been going on in terms of blocking America's access to the truth. And we have to build on this, but Senator McCain is right—we all have to recognize, this Congress has got to take the steps to deal with this. The signs are everywhere.

I've just finished, actually, writing a book on this. You can look at what's happening in Alaska alone. I think, Senator, if I'm wrong—didn't they spend several hundred million dollars to move a village?

Senator STEVENS. About to.

Senator KERRY. They are going to have to do it. And, the fisherman can't go out and fish to the extent they were, because the slush is such, they can't ride snowmobiles, reduced to boats, the winter storms prevent them from doing it—life is changing.

Senator STEVENS. I'd add to that, they can't afford the gas.

Senator KERRY. And they can't afford it.

In Alaska they can't afford it? God, I thought they gave it to them for free there.

[Laughter.]

Senator KERRY. When you sit with Jim Hansen, and Dr. Hansen tells you months ago that within the next 30 years, the Arctic ice

is going to disappear, it's not a question of if, and, or but. Barring some God-intervention that we can't predict, it's gone. And that means more water exposed to the sun, which heats up, which means the Greenland Ice Sheet is more at risk, and we're just playing with the potential for catastrophe. So, I thank you, Mr. Chairman. I think there is nothing more important for us to focus on, and I intend to certainly pour my energies into this, because I think it's a great challenge of our time.

The CHAIRMAN. I thank you very much. I was ready to pack my bags.

Senator Lautenberg?

STATEMENT OF HON. FRANK R. LAUTENBERG, U.S. SENATOR FROM NEW JERSEY

Senator LAUTENBERG. Thanks, Mr. Chairman, for holding this hearing, and finally coming to grips with something that has been obvious in our view for some time now.

And I do want to welcome this distinguished panel, particularly Mr. Tom Knutson, who is a scientist from the NOAA lab in Princeton, New Jersey.

The first question that arises is whether or not there's actually global warming taking place? And finally, when it smacks us in the face, we say, "You know what? It feels warmer here." The warmest month, the warmest year, all of the statistics that tell you what the condition is.

I sit on another committee, the Environment and Public Works Committee, and it was there that it was suggested that global warming was one of the worst—was the worst hoax perpetrated on man. And this is not years ago, this is weeks ago that this proposition was put out in front of us.

The next one was whether or not human action has any influence on it. We had a scientist there who was brought in from France, from the Pasteur Institute, who said that there was really a global warming going on, that we'd see more incidents of malaria. And we don't see the mosquito population growing, that was very comforting, I must tell you.

So, this total state of denial is ridiculous, and finally, now, the truth is going to come out. If anyone had any doubt on global warming's effect on the Earth, or the human effect on global warming, the recent IPCC report just erased all of the doubt. The work of 2,500 scientists, 113 countries, researchers who were free to let science speak for itself, down to my colleagues, who have said the theory that the warming of the climate system is unequivocal, and human activity is to blame.

The importance of what the report says is the fact that this report relies on uncensored, unedited, unmodified science to say so. In contrast to the honesty of the IPCC Report, the Bush Administration has permitted the removal, the censored redaction of data, that was developed, destroying the meaning of the scientists in order to advance a political agenda.

The Administration has obstructed, blocked, and delayed release of government reports on global warming, they deleted key words, "global warming," "warming climate" from public documents. It's

hard to imagine that something so crude would purvey the Administration's view, and the handling of science.

Well, we're going to make a change, this Committee's hearing indicates that, as was said in a movie, "we're sick and tired of it, we're not going to take it anymore."

Thank you very much.

The CHAIRMAN. Thank you very much, and now may I call upon Senator Klobuchar?

STATEMENT OF THE HON. AMY KLOBUCHAR, U.S. SENATOR FROM MINNESOTA

Senator KLOBUCHAR. Thank you, Mr. Chairman, and I'm very pleased that the Commerce Committee is looking at the issue of global warming.

I'm on the Agriculture Committee and the Environment and Public Works Committee, in addition to this committee, so it puts me in a unique position to continue to work on this issue. The bad news is Secretary Johanns is testifying in the Agriculture Committee, so I'm going to be brief.

I was just at home, in Minnesota over the weekend, where you know, we had 70-below-zero wind chills. So, global warming, I didn't think, would be the topic people would want to talk about. But, it was amazing to me, whether it was hunters who are seeing the effects firsthand throughout our state, or people who ice fish who took months to put their fish houses out. People are very concerned about this. It has gone beyond the science, to regular people seeing the effects of global warming in our state, and wanting to do something about it.

Like most Americans, I'm an optimist. I come from the state that gave you the pacemaker and the Post-It note, and I believe in the power of science, in the power of innovation, in the power of technology. I believe in the intelligence and the ingenuity of the American people when we're confronted with a challenge. That's why I'm so troubled when I hear about efforts to elevate politics over science; when I learn that our best and our brightest thinkers and researchers are not getting the breathing space that they need to do their work.

I believe we can do better. I come from the background of a prosecutor, and the cardinal rule in our job is that evidence, and not politics, determines our decisions in charging and prosecuting criminals. That's a simple but all-important concept. And that's where I come from when I look at this issue before us today.

That's why I think our government's approach to climate change has to rest on three principles. Our policy decisions on climate change and global warming must be guided by the best science available, not by the worst partisan politics. Second, our government has a duty to give our scientists and researchers all of the support they need to help us confront and overcome this enormous challenge. And third, the American public has a right to hear, consider and debate the conclusions of our scientists. And our scientists have a right to express their views without government interference or suppression.

If we do not adhere to these principles, we're going to be falling farther, and farther behind in our efforts to tackle global warming.

I appreciate the leadership of people in this room, like Senator McCain, and Senator Kerry on this issue. I believe we are close to getting things done on this issue, that there is a movement across this country, a bipartisan movement. But, to do that, we have to get the science right, and we can't suppress the work of our scientists.

So, I thank you, thank you very much.

The CHAIRMAN. Thank you very much, Senator. And now we come to the panel.

Our first witness, the Deputy Assistant Secretary for International Affairs at the National Oceanic and Atmospheric Administration, and Acting Director of the Climate Change Science Program, Dr. Bill Brennan.

Dr. Brennan?

STATEMENT OF DR. WILLIAM BRENNAN, ACTING DIRECTOR, U.S. CLIMATE CHANGE SCIENCE PROGRAM, DEPUTY ASSISTANT SECRETARY FOR INTERNATIONAL AFFAIRS, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DOC

Dr. BRENNAN. Thank you, Mr. Chairman, I'll see if I can encroach on Dr. Anthes' space just a little bit here.

Chairman Inouye, and Vice Chairman Stevens, I appreciate the opportunity to testify before you today about climate change research and scientific integrity.

My name is Bill Brennan, and since June 2006, I have been the Acting Director of the U.S. Climate Change Science Program, in addition to my position as the Deputy Assistant Secretary for International Affairs with the Department of Commerce's National Oceanic and Atmospheric Administration.

In 2001, President Bush commissioned the National Academy of Sciences to do a special report on the state of the science on climate change. The Academy responded that the surface temperature of the Earth is warming, and that human activities are largely responsible. The President followed up on this report by creating a special cabinet-level committee, headed by the Departments of Commerce and Energy, as well as creating the Climate Change Science Program, and the Climate Change Technology Program, to lead the Administration's efforts to confront this serious environmental problem.

CCSP integrates Federal research on global change, and oversees the nearly $2 billion spent by 13 Federal agencies. This program is charged with investigating natural and human-induced changes to Earth's environmental systems, and to monitoring and understanding and predicting global change. The goal is to provide a sound, scientific basis for Federal, State, and local decisionmakers, resource managers, the science community, the media, and the general public.

With the February 2, 2007 release of the latest report by the Intergovernmental Panel on Climate Change, there is even more certainty about the observed warming as a result of the increase in greenhouse gases for which humans have been responsible. Not only does the Bush Administration accept the report, U.S. science

and government played a large role in its development. Many U.S. scientists were instrumental in putting this report together.

U.S. observation networks, computer modeling labs and research programs all provided crucial data and analyses. Without the efforts of the United States, much of this report would not have been possible.

Over the next 2 years, CCSP will be completing a series of 21 Synthesis and Assessment Reports. The first report released in May 2006, helped correct errors identified in satellite data, and contributed significantly to the IPCC's findings. Soon, we will have a report on the North American carbon cycle, which will focus on key issues for carbon management and policy. Later this year, the CCSP will address the sensitivity and adaptability of ecosystems to climate change.

These reports are being developed with an intensive commitment to scientific peer-review, transparency and public involvement. CCSP continues to engage the National Research Council, to provide a review of the conduct and performance of the program, and their analysis is available to the public.

I want to thank Dr. James Mahoney for all of his efforts in creating this process, and leading the CCSP for the last 4 years.

Regarding concerns about scientific communications, I think it is important to point out that to the best of my knowledge, no one has suggested the science or the research findings have been interfered with. But concerns have been raised about the intersection of science policy and science, and how that is communicated to the public. The Bush Administration strongly believes scientific findings should be communicated clearly, accurately and completely. The White House has asked Departments and agencies to review their respective policies to ensure scientific openness, and ensure that employees and management understand their rights and obligations under these policies.

Some NOAA scientists have expressed concerns about their ability to talk to the media. Admiral Lautenbacher, NOAA's Administrator, and a scientist himself, sent communications to every NOAA employee, clearly stating his commitment to scientific integrity and open discussion of scientific results. He has conducted several town hall meetings around the country with NOAA employees, and expressly stated that anyone who feels that NOAA or the Department of Commerce are not supporting the free flow of scientific research, they should contact him personally.

The Department has revised three outdated and contradictory communications policies. Under the new policy, scientists and researchers are free to communicate their research findings, and are encouraged to work with the public affairs office when it comes to communicating the research. However, this is not a requirement.

This new policy also contains a strong appeals process to quickly address any issues that may arise, and NOAA scientists and employees provided the Department with valuable feedback, and have helped make this policy a much better product.

Since 2001, the Bush Administration has been clear that climate change is a serious problem. The Earth is warming, and humans are the leading cause. The Administration has spent nearly $29 billion on climate change, including $9 billion on climate change

science, more than all other nations combined. U.S. researchers and funding are responsible for much of the world's understanding of climate change, and the recent IPCC report would not have been possible without the United States.

Regarding scientific communications and openness, the Administration takes the concerns of its scientists very seriously, and I am particularly proud of the CCSP Program, which has a process that is open and transparent, including public reviews of its reports, and independent reviews of its performance.

Thank you, Mr. Chairman, for allowing me to testify before you today.

[The prepared statement of Dr. Brennan follows:]

PREPARED STATEMENT OF DR. WILLIAM BRENNAN, ACTING DIRECTOR, U.S. CLIMATE CHANGE SCIENCE PROGRAM, DEPUTY ASSISTANT SECRETARY FOR INTERNATIONAL AFFAIRS, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DOC

Chairman Inouye and Vice Chairman Stevens, I appreciate the opportunity to testify to you today about climate change research and scientific integrity. My name is Bill Brennan, and since June 2006, I have been the Acting Director of the U.S. Climate Change Science Program, as well as the Deputy Assistant Secretary for International Affairs with the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA).

I will first talk about the Climate Change Science Program and the current state of climate research and then I will discuss the issue of scientific communications, emphasizing issues at NOAA.

What Is CCSP?

The U.S. Climate Change Science Program (CCSP) was established by President Bush in 2002 and integrates Federal research on global climate change, as sponsored by 13 Federal agencies.[1] CCSP is a multi-agency program charged with: investigating natural and human-induced changes in the Earth's global environmental system; monitoring, understanding, and predicting global change; and providing a sound scientific basis for national and international decisionmaking. The CCSP combines the near-term focus of the Administration's Climate Change Research Initiative, initiated in 2001—including a focus on advancing the understanding of aerosols, carbon sources and sinks, and improvements in climate modeling—with the breadth of the long-term research elements of the U.S. Global Change Research Program.

Since CCSP was created in 2002, the program has successfully integrated a wide range of research, climate science priorities and budgets of the 13 CCSP agencies. CCSP integrates research and observational approaches across disciplinary boundaries and is also working to create more seamless approaches between theory, modeling, observations, and applications required to address the multiple scientific challenges posed by changes in climate. CCSP is taking on the most challenging questions in climate science and is developing products to convey the most advanced state of knowledge to be used by Federal, state and local decisionmakers, resource managers, the science community, the media, and the general public. Since 2002, the Administration has spent approximately $9 billion on climate change science.

Agreement on Climate Change

In 2001, the President asked the National Academy of Sciences to do a special report on the state of the science on climate change. The report, entitled *Climate Change Science: An Analysis of Some Key Questions* stated: "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface temperatures and subsurface ocean temperatures to rise. Temperatures are, in fact, rising. The changes observed over the last several decades are likely mostly due to human activities, but we cannot rule out that some significant part of these changes

[1] The CCSP participating agencies include the Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, the Interior, State, and Transportation, the National Science Foundation, the Environmental Protection Agency (EPA), the National Aeronautics and Space Administration (NASA), U.S. Agency for International Development, and the Smithsonian Institution. Additional CCSP liaisons reside in the Office of Science and Technology Policy, the Council on Environmental Quality, the National Economic Council, and the Office of Management and Budget.

is also a reflection of natural variability." In reaction to the report, the President created a cabinet-level committee, and in particular CCSP and the Climate Change Technology Program to lead the Administration's efforts to confront this serious environmental problem. Since 2001, the Administration has devoted nearly $29 billion to climate-related science, technology, international assistance, and incentive programs.

The latest report by the Intergovernmental Panel on Climate Change (IPCC), released on February 2, 2007, expressed even more certainty that the changes observed over the last several decades are mostly due to human activities, primarily through the release of greenhouse gases.

The Bush Administration accepts the published report, and notes that the U.S. Government played a large role in its development. Many U.S. scientists were instrumental in putting together this report, especially Dr. Susan Solomon, a senior scientist at NOAA's Earth System Research Laboratory in Boulder, Colorado, who was Co-Chair of the Working Group I (WG1). U.S. observations networks, computer modeling efforts, and research programs all provided crucial data and analysis. Without the efforts of the Administration and the CCSP program, much of this report would not have been possible.

The U.S. Climate Change Science Program managed the U.S. author nomination process for IPCC WG1, including soliciting complete applications, interfacing with relevant Technical Support Units and the Secretariat in Geneva, convening disciplinary expert panels, hosting series' of meetings, and consolidating all materials of selected finalists. CCSP also managed the Expert and Government Reviews for WG1 by providing technical advice and networking infrastructure. CCSP agencies assisted with issuing a public call for comments, collecting comments, assembling expert panels to review inputs for technical merit, accepting/rejecting/modifying said input, and preparing the final package.

The work conducted by the Federal agencies as part of CCSP was critical to gaining a greater understanding of climate change processes, including relating observations and models, for the IPCC report. CCSP Synthesis and Assessment Report 1.1 reconciled lingering and long-standing difficulties that have impeded understanding of changes in atmospheric temperatures and the basic causes of these changes. It brought models and observations more closely in line, and provided increased confidence in our ability to model and predict future changes.

Over the next 2 years CCSP will be completing a series of 21 Synthesis and Assessment Reports, with the report on emissions scenarios to be released shortly. These reports describe the state of the science on a range of key issues, thereby providing further important contributions to the Nation's and world's discussion on climate change. The first report, released in May 2006, helped correct errors identified in satellite data and other temperature observations in the troposphere and stratosphere, and contributed significantly to the IPCC's increased confidence in the influence of anthropogenic greenhouse gases on temperature increase since the mid-20th century. Due out in the next couple of months will be a report on the North American Carbon Cycle, which will focus on key issues for carbon management and policy. In addition, later this year the CCSP will release several products that address the sensitivity and adaptability of ecosystems to climate change.

How Are CCSP Reports Produced?

I want to describe the process by which the Climate Change Science Program is producing its 21 reports—which is with an intensive commitment to scientific peer review, transparency and public involvement. The specific details of each step of the process are available on the CCSP website (*http://www.climatescience.gov*). All of the products are being drafted by expert groups in compliance with the provisions of the Federal Advisory Committee Act and each product will receive intensive scientific peer review, as well as at least two general public reviews (one for the prospectus and one for the full report). CCSP has also engaged the National Research Council (NRC) to provide continuing analysis and advice on the conduct of the CCSP program including the preparation of the CCSP scientific products. The NRC advisory reports will all be public documents, and will provide the Congress and all interested stakeholders with independent reviews of CCSP performance. I want to publicly acknowledge and thank Dr. James Mahoney, who is on the panel today, for all his work and efforts in creating this process and leading the CCSP program for 4 years.

Administration View on Scientific Communications

The Bush Administration values science as a basis for effective policy action in its service to the public, and regards the timely, complete and accurate communication of scientific information as an important part of that service. The White House,

through the Office of Science and Technology Policy, asked departments and agencies to review their respective policies to ensure scientific openness and that employees and management understand their rights and obligations under these policies.

NOAA Scientific Communication

The media have covered a handful of instances where NOAA scientists have expressed concerns about their ability to talk to the media about their research. Admiral Lautenbacher, NOAA's Administrator and a scientist himself, continues to take this issue very seriously. He has sent communications to every NOAA employee about the importance of open communications, as science is the foundation for everything that NOAA does as an agency. He has conducted several town hall meetings around the country with NOAA employees and expressly stated that anyone who feels that NOAA or the Department of Commerce processes are not supporting the free flow of scientific research should contact him personally. I would like to point out that NOAA scientists publish between 800 and 1,000 scientific papers a year. In coordination with NOAA's public affairs office, frequent interviews are conducted on our research and several hundred press releases are sent out each year.

DOC Communication's Policy

The issue of scientific integrity is important not only to NOAA but also the Department of Commerce, which has several bureaus, in addition to NOAA where scientists and researchers provide crucial information to the media and the public on a regular basis. Secretary Gutierrez and Deputy Secretary Sampson have made this issue a top priority for the Department and have reiterated their strong support for open communication of peer-reviewed science. When the Department reviewed its current communications policies, it found they dated back decades and are based on those set up by President Jimmy Carter. There are actually three different department-wide orders that at times are contradictory and certainly are woefully outdated. The Department has accordingly decided to consolidate and simplify the three dated policies into one policy relevant to current times.

It is my understanding that the drafting process is almost complete and that the Department is in the process of fulfilling its labor relations obligations regarding union consultation. In this drafting process, the Department sought the input of many scientists and employees. As I understand it, this was an unprecedented process, involving three separate rounds of input and feedback. The Department has been very pleased with the constructive feedback and officials feel the draft policy has been greatly improved due to this feedback. The policy will reaffirm the Department's goal of fostering transparency and media and public access, including a specific statement that clarifies the independence of fundamental research communications. And, the new policy has a strong appeals process so that if someone feels aggrieved, they can seek a quick appeal. It has been and continues to be the Secretary's policy and that of his leadership team to encourage and support open communication of scientific research and findings.

Conclusion

Since 2001, the Bush Administration has spent $29 billion on climate-related science, technology, international assistance, and incentive programs. Federal researchers and grant money from the U.S. Government contribute substantially to the world's understanding of climate change. The recent IPCC report would not have been possible without the United States. The Administration has been clear that climate change is a serious problem, the Earth is warming and humans are the leading cause.

The report of Working Group I of the IPCC demonstrates that the level of scientific certainty has increased regarding the human impact on climate change. However, more research must be done to answer the many questions and uncertainties that remain in this field, such as the role aerosols and deep ocean currents play in regulating the climate, as well as further work on the relationship between climate frequency, distribution, and severity of extreme weather events, such as tropical cyclones and drought.

Regarding scientific communications and openness, the Administration takes the concerns of its scientists very seriously, and each Department and Agency is reviewing (and modifying if necessary) its policies to ensure government scientists do not face censorship on any scientific matter, including climate change issues. The CCSP program has an open and transparent process, which includes several public reviews before any reports are finalized. The Department of Commerce is also in the final stages of revising and updating its policies to ensure open communication of scientific research and findings.

Thank you again, Mr. Chairman for allowing me the opportunity to testify on these important issues.

The CHAIRMAN. I thank you very much, Dr. Brennan. And now, may I call on Dr. Richard A. Anthes, President of the University Corporation for Atmospheric Research.

Dr. Anthes?

STATEMENT OF RICHARD A. ANTHES, PH.D., PRESIDENT, UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH (UCAR); CO-CHAIR, COMMITTEE ON EARTH SCIENCE AND APPLICATIONS FROM SPACE, NATIONAL RESEARCH COUNCIL, THE NATIONAL ACADEMIES

Dr. ANTHES. Is that OK?

Mr. Chairman, Vice Chairman, and members of the Committee, thank you for inviting me to testify here today.

My name is Richard Anthes, and I am President of UCAR, the University Corporation for Atmospheric Research. We manage the National Center for Atmospheric Research, or NCAR, under sponsorship of the National Science Foundation. I'm also current President of the American Meteorological Society.

But, I am here today largely in my capacity as Co-Chair of the National Research Council's Committee on Earth Science, and Applications from Space. I've been asked to discuss some of the recommendations from the recently completed report: *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond.* This report, which was requested by NASA, NOAA, and the USGS was a result of more than 2 years of work by over 100 leaders in the broad Earth science community.

As explained in more detail in my written testimony, the Committee's recently completed report provides a prioritized roadmap of Earth observations to advance Earth science and applications from space, from short-term needs for information, such as weather forecasts and warnings and protection of life and property, to longer-term scientific understanding that is essential for understanding our planet, and how our planet supports and sustains life.

The Committee's vision is encapsulated in the following declaration, first stated in our Committee's interim report, published in 2005. "Understanding the complex changing planet on which we live, how it supports life, and how human activities affect its ability to do so in the future, is one of the greatest intellectual challenges facing humanity. It is also one of the most important challenges for society, as it seeks to achieve prosperity, health and sustainability."

As detailed in our final report, and as we were reminded by reading the front page of nearly every newspaper this past week, describing the powerful findings of the latest Report from the IPCC, our society is faced with a number of profound scientific and societal challenges, including climate change, and their impacts on our key parts of our economy, human health, sea level, eco-systems, patterns of precipitation, and water availability.

In addition to the ever-increasing need for better weather forecasts and warnings, we also need to know more about air quality and extreme natural events, including severe storms, heat waves, Earthquakes and volcanic eruptions.

Yet, at a time when the need has never been greater, we are faced with an Earth observation program that will dramatically diminish in capability over the next 10 to 15 years.

The 2005 interim report warned of a national system of environmental satellites that was "at risk of collapse." That judgment, which may have seemed somewhat extreme at the time, was based on the observed, precipitous decline in funding for Earth-observation missions and the consequent cancellation, de-scoping and delay of a number of critical missions and instruments, which you see here, illustrated in this first slide.

This slide shows the decrease in the number of missions and the number of instruments of U.S. Earth observations from space. We have reached the golden age of Earth observations from space, if this trend is not reversed, with a maximum of instruments and observations in space in 2006. You see a decrease, by 2010 of something like 35 percent, in the number of instruments in space.

Since the publication of our interim report, NASA has delayed or canceled several missions, significant cuts have been made to NASA's research and analysis accounts, NOAA's NPOESS preparatory project mission was delayed for a year and a half, the key sensor plan for the next generation of NOAA geo-stationary satellites was canceled, and the NPOESS program breached the Nunn-McCurdy budget cap, with the latter having particular consequences for the measurement of forcing and feedbacks needed to observe and understand global and regional climate change. It is against this backdrop that I discuss the present report.

Mr. Chairman, it is often said that when you're in a hole, you should stop digging. Our report recommends a path forward, that restores U.S. leadership in Earth science and applications and averts the potential collapse of our system of environmental satellites. As documented in our report, this can be done in a fiscally responsible manner.

As you will observe in slide two, you will see that our recommendation can be implemented in a cost-effective manner by simply restoring NASA's Earth science budget to 2002 levels. These numbers are in constant Fiscal Year 2006 dollars.

We make a number of specific recommendations which I will summarize briefly here. Even in a constrained fiscal environment, we believe it's imperative that NOAA restore key climate, environmental and weather capabilities to the NPOESS mission. These include restoring capabilities to measure total solar radiation, and Earth radiation, ocean surface vector winds, and sea surface temperature and ozone profiles.

We also recommend that NASA undertake 15 new missions in the period 2008 to 2020. In addition to restoring some of the capabilities lost on NPOESS, these missions will provide an integrated, robust program to advance Earth system science, and derive numerous benefits of critical importance to society, including of particular relevance to this hearing, improved weather and climate prediction.

Implementing these missions will not only greatly reduce the risk to the people of our country, and the world, of natural hazards of all kinds, it will support more efficient management of natural resources, including water, energy, fisheries, eco-systems, and sup-

port the economy and industries, so that the cost of this program is repaid many times over.

Our report also discusses the need for improved coordination between NASA and NOAA in making these measurements. Mismatches in the missions between NOAA and NASA can lead to difficulty in transitioning NASA research measurements into NOAA operational measurements, therefore our committee recommends that the Office of Science and Technology Policy develop and implement a comprehensive plan for achieving and sustaining global Earth observations.

Mr. Chairman, the observing system we envision will help establish a firm and sustainable foundation for Earth science, and associated societal benefits through the year 2020 and beyond, will be achieved through effective management of technology advances and international partnerships, and broad use of satellite science data by the research and decisionmaking community.

Thank you for the opportunity to appear before you today. I'd be happy to answer any questions you have.

[The prepared statement of Dr. Anthes follows:]

PREPARED STATEMENT OF RICHARD A. ANTHES, PH.D., PRESIDENT, UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH (UCAR); CO-CHAIR, COMMITTEE ON EARTH SCIENCE AND APPLICATIONS FROM SPACE, NATIONAL RESEARCH COUNCIL, THE NATIONAL ACADEMIES

Mr. Chairman, Vice Chairman, and Members of the Committee: thank you for inviting me here to testify today. My name is Richard Anthes, and I am the President of the University Corporation for Atmospheric Research, a consortium of 70 research universities that manages the National Center for Atmospheric Research, on behalf of the National Science Foundation, and additional scientific education, training and support programs. I am also the current President of the American Meteorological Society. I appear today in my capacity as Co-Chair of the National Research Council (NRC)'s Committee on Earth Science and Applications from Space: A Community Assessment and Strategy for the Future.

The National Research Council is the unit of the National Academies that is responsible for organizing independent advisory studies for the Federal Government on science and technology. In response to requests from NASA, NOAA, and the USGS, the NRC has recently completed a "decadal survey" of Earth science and applications from space. ("Decadal surveys" are the 10-year prioritized roadmaps that the NRC has done for 40 years for the astronomers; this is the first time it is being done for Earth science and applications from space.) Among the key tasks in the charge to the decadal survey committee were to:

- Develop a consensus of the top-level scientific questions that should provide the focus for Earth and environmental observations in the period 2005–2020; and
- Develop a prioritized list of recommended space programs, missions, and supporting activities to address these questions.

The NRC survey committee has prepared an extensive report in response to this charge, which I am pleased to be able to summarize here today. Over 100 leaders in the Earth science community participated on the survey steering committee or its seven study panels. It is noteworthy that this was the first Earth science decadal survey, and the Committee and panel members did an excellent job in fulfilling the charge and establishing a consensus—a task many previously considered impossible. A copy of the full report has also been provided for your use.*

The Committee's vision is encapsulated in the following declaration, first stated in the Committee's interim report, published in 2005:

> "Understanding the complex, changing planet on which we live, how it supports life, and how human activities affect its ability to do so in the future is one of the greatest intellectual challenges facing humanity. It is also one of the most

*A copy of this report is maintained in the Committee's files.

important challenges for society as it seeks to achieve prosperity, health, and sustainability."

As detailed in the Committee's final report, and as we were profoundly reminded by reading the front page of nearly every newspaper this past week describing the powerful findings of the latest report from the International Panel on Climate Change (IPCC), the world faces significant and profound environmental challenges: shortages of clean and accessible freshwater, degradation of terrestrial and aquatic ecosystems, increases in soil erosion, changes in the chemistry of the atmosphere, declines in fisheries, and above all the rapid pace of substantial changes in climate. These changes are not isolated; they interact with each other and with natural variability in complex ways that cascade through the environment across local, regional, and global scales. Addressing these societal challenges requires that we confront key scientific questions related to ice sheets and sea level change, large-scale and persistent shifts in precipitation and water availability, transcontinental air pollution, shifts in ecosystem structure and function in response to climate change, impacts of climate change on human health, and occurrence of extreme events, such as hurricanes, floods and droughts, heat waves, Earthquakes, and volcanic eruptions.

Yet at a time when the need has never been greater, we are faced with an Earth observation program that will dramatically diminish in capability over the next 10–15 years.

Last April, my Co-Chair, Dr. Berrien Moore, came before Congress to testify in response to release of the Committee's 2005 interim report. His testimony highlighted the key roles played by NASA and NOAA over the past 30 years in advancing our understanding of the Earth system and in providing a variety of societal benefits through their international leadership in Earth observing systems from space. He noted that while NOAA had plans to modernize and refresh its weather satellites, NASA had no plans to replace its Earth Observing System platforms after their nominal 6 year lifetimes end. He also noted that NASA had canceled, scaled back, or delayed at least six planned missions, including a Landsat continuity mission. This led to the main finding in the interim report, which stated "this system of environmental satellites is at risk of collapse."

Since the publication of the interim report, the Hydros and Deep Space Climate Observatory missions were canceled; the flagship Global Precipitation Mission was delayed for another two and a half years; significant cuts were made to NASA's Research and Analysis program: the NPOESS Preparatory Project mission was delayed for a year and a half; a key atmospheric profiling sensor planned for the next generation of NOAA geostationary satellites was canceled; and the NPOESS program breached the Nunn-McCurdy budget cap. As you have all heard, the certified NPOESS program delays the first launch by 3 years, eliminates 2 of the planned 6 spacecraft, and de-manifests or de-scopes a number of instruments, with particular consequences for measurement of the forcing and feedbacks that need to be measured to understand the magnitude, pace, and consequences of global and regional climate change. It is against this backdrop that I discuss the present report.

As you will see in the report, between 2006 and the end of the decade, the number of operating missions will decrease dramatically and the number of operating sensors and instruments on NASA spacecraft, most of which are well past their nominal lifetimes, will decrease by some 35 percent, with a 50 percent reduction by 2015 (see *Figure 1* below). Substantial loss of capability is likely over the next several years due to a combination of decreased budgets and aging satellites already well past their design lifetimes.

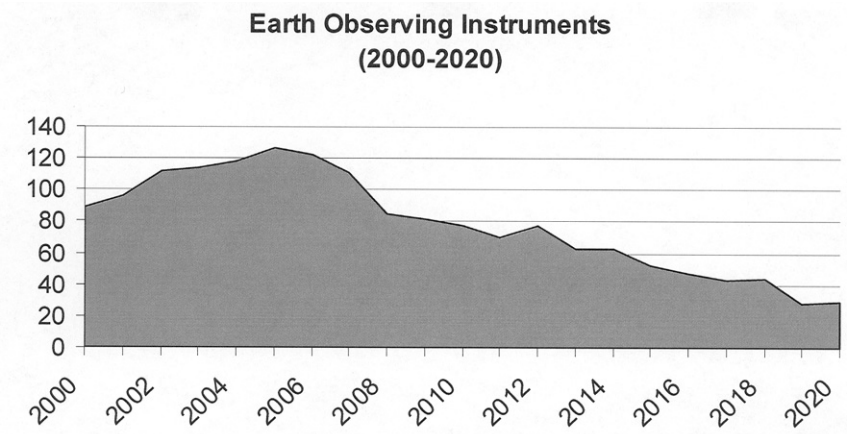

Figure 1. Number of current and planned U.S. space-based Earth Observations instruments, not counting the recommended missions in the Committee's report. For the period from 2007 to 2010, missions were generally assumed to operate for four years past their nominal lifetimes. SOURCE: Information from NASA and NOAA websites for mission durations.

In its report, the Committee sets forth a series of near-term and longer-term recommendations in order to address these troubling trends. It is important to note that this report does not "shoot for the moon," and indeed the Committee exercised considerable constraint in its recommendations, which were carefully considered within the context of challenging budget situations. Yet, while societal applications have grown ever-more dependent upon our Earth observing fleet, the NASA Earth science budget has declined some 30 percent in constant-year dollars since 2000 (see *Figure 2* below). This disparity between growing societal needs and diminished resources must be corrected. This leads to the report's overarching recommendation:

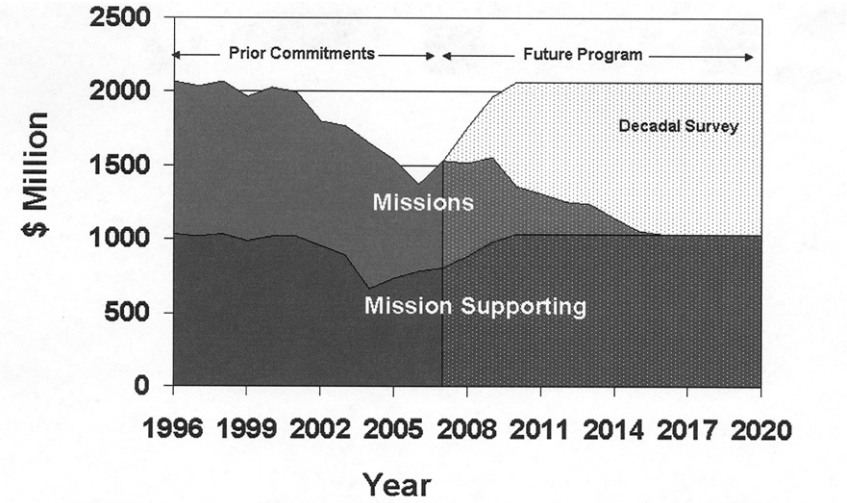

Figure 2. NASA budget for Earth Sciences adjusted to constant FY 2006 dollars and adjusted for the effects of full-cost accounting.

> "The U.S. Government, working in concert with the private sector, academe, the public, and its international partners, should renew its investment in Earth observing systems and restore its leadership in Earth science and applications."

The report outlines near-term actions meant to stem the tide of capability deterioration and continue critical data records, as well as forward-looking recommendations to establish a balanced Earth observation program designed to directly address the most urgent societal challenges facing our Nation and the world (see *Figure 3* below for an example of how nine of our recommended missions support in a synergistic way one of the societal benefit areas—extreme event warnings). It is important to recognize that these two sets of recommendations are not an "either/or" set of priorities. *Both* near-term actions *and* longer-term commitments are required to stem the tide of capability deterioration, continue critical climate data records, *and* establish a balanced Earth observation program designed to directly address the most urgent societal challenges facing our Nation and the world. It is important to "right the ship" for Earth science, and we simply *cannot* let the current challenges we face with NPOESS and other troubled programs stop progress on all other fronts. Implementation of the "stop-gap" recommendations concerning NPOESS, NPP, and GOES–R are important—and the recommendations for establishing a healthy program going forward are equally as important. Satisfying near-term recommendations without placing due emphasis on the forward-looking program is to ignore the largest fraction of work that has gone into this report. Moreover, such a strategy would result in a further loss of U.S. scientific and technical capacity, which could decrease the competitiveness of the United States internationally for years to come.

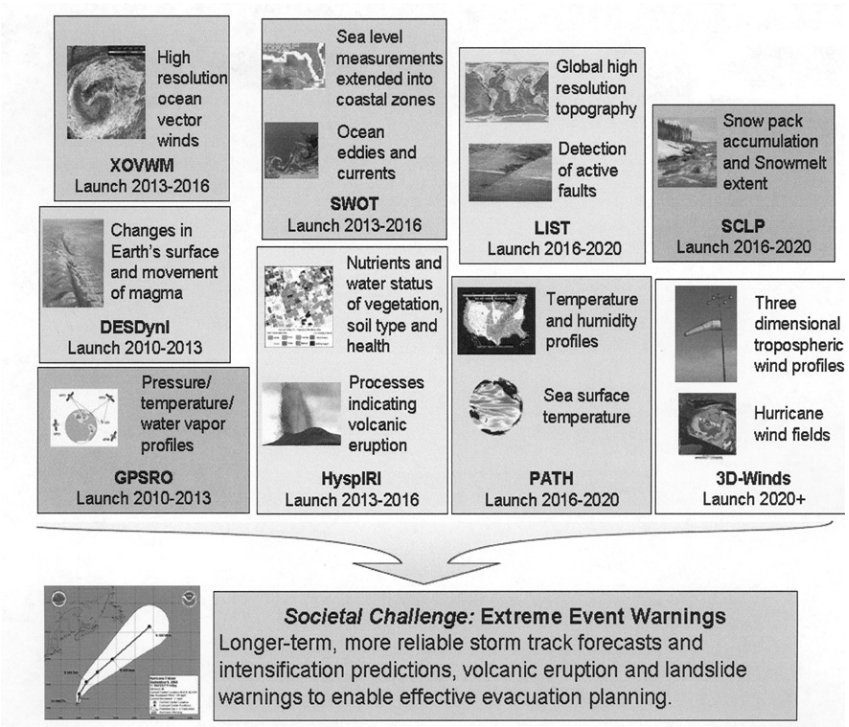

Figure 3. Illustration showing how recommended missions work together to address societal challenges. Numerous additional examples are available in Chapter 2 of the final report.

Key elements of the recommended program include:

1. Restoration of certain measurement capabilities to the NPP, NPOESS, and GOES–R spacecraft in order to ensure continuity of critical data sets.

2. Completion of the existing planned program that was used as a baseline assumption for this survey. This includes (but is not limited to) launch of GPM in or before 2012, securing a replacement to Landsat 7 data before 2012.

3. A prioritized set of 17 missions to be carried out by NOAA and NASA over the next decade (see *Tables 1* and *2* below). This set of missions provides a sound foundation for Earth science and its associated societal benefits well beyond 2020. *The committee believes strongly that these missions form a minimal, yet robust, observational component of an Earth information system that is capable of addressing a broad range of societal needs.*

4. A technology development program at NASA with funding comparable to and in addition to its basic technology program to make sure the necessary technologies are ready when needed to support mission starts over the coming decade.

5. A new "Venture" class of low-cost research and application missions that can establish entirely new research avenues or demonstrate key application-oriented measurements, helping with the development of innovative ideas and technologies. Priority would be given to cost-effective, innovative missions rather than ones with excessive scientific and technological requirements.

6. A robust NASA Research and Analysis program, which is necessary to maximize scientific return on NASA investments in Earth science. Because the R&A programs are carried out largely through the Nation's research universities, such programs are also of great importance in supporting and training next-generation Earth science researchers.

7. Suborbital and land-based measurements and socio-demographic studies in order to supplement and complement satellite data.

8. A comprehensive information system to meet the challenge of production, distribution, and stewardship of observational data and climate records. To ensure the recommended observations will benefit society, the mission program must be accompanied by efforts to translate raw observational data into useful information through modeling, data assimilation, and research and analysis.

Table 1. Launch, orbit, and instrument specifications for the recommended NOAA missions. Detailed descriptions of the missions are given in Part II of the final report, and Part III provides the foundation for selection.

Decadal Survey Mission	Mission Description	Orbit	Instruments	Rough Cost Estimate (in millions)
Timeframe: 2010–2013—Missions listed by cost Small Missions (<$300 million)				
CLARREO (Instrument Reflight Components)	Solar and Earth radiation characteristics for understanding climate forcing	LEO, SSO	Broadband radiometers	65
GPSRO	High accuracy, all-weather temperature, water vapor, and electron density profiles for weather, climate and space weather	LEO	GPS receiver	150
Timeframe: 2013–2016—Missions listed by cost Medium Missions ($300–$600 million)				
XOVWM	Sea surface wind vectors for weather and ocean ecosystems	LEO, SSO	Backscatter radar	350

Table 2. Launch, orbit, and instrument specifications for the recommended NASA missions. Detailed descriptions of the missions are given in Part II of the final report, and Part III provides the foundation for selection.

Decadal Survey Mission	Mission Description	Orbit	Instruments	Rough Cost Estimate (in millions)
Timeframe: 2010–2013—Missions listed by cost Small Missions (<$300 million)				
CLARREO (NASA portion)	Solar and Earth radiation, spectrally resolved forcing and response of the climate system	LEO, Precessing	Absolute, spectrally-resolved interferometer	200
Medium Missions ($300–$600 million)				
SMAP	Soil moisture and freeze/thaw for weather and water cycle processes	LEO, SSO	L-band radar, L-band radiometer	300
ICESat-II	Ice sheet height changes for climate change diagnosis	LEO, Non-SSO	Laser altimeter	300
Large Missions ($300–$900 million)				
DESDynI	Surface and ice sheet deformation for understanding natural hazards and climate; vegetation structure for ecosystem health	LEO, SSO	L-band InSAR, Laser altimeter	700
1**Timeframe: 2013–2016—Missions listed by cost Medium Missions ($300–$600 million)**				
HyspIRI	Land surface composition for agriculture and mineral characterization; vegetation types for ecosystem health	LEO, SSO	Hyperspectral spectrometer	300
ASCENDS	Day/night, all-latitude, all-season CO_2 column integrals for climate emissions	LEO, SSO	Multifrequency laser	400
SWOT	Ocean, lake, and river water levels for ocean and inland water dynamics	LEO, SSO	Ka-band wide swath radar, C-band radar	450
GEO–CAPE	Atmospheric gas columns for air quality forecasts; ocean color for coastal ecosystem health and climate emissions	GEO	High and low spatial resolution hyperspectral imagers	550
Large Missions ($600–$900 million)				
ACE	Aerosol and cloud profiles for climate and water cycle; ocean color for open ocean biogeochemistry	LEO, SSO	Backscatter lidar, Multiangle polarimeter, Doppler radar	800

Table 2. Launch, orbit, and instrument specifications for the recommended NASA missions. Detailed descriptions of the missions are given in Part II of the final report, and Part III provides the foundation for selection.—Continued

Decadal Survey Mission	Mission Description	Orbit	Instruments	Rough Cost Estimate (in millions)
Timeframe: 2016–2020—Missions listed by cost Medium Missions ($300–$600 million)				
LIST	Land surface topography for landslide hazards and water runoff	LEO, SSO	Laser altimeter	300
PATH	High frequency, all-weather temperature and humidity soundings for weather forecasting and SST*	GEO	MW array spectrometer	450
GRACE–II	High temporal resolution gravity fields for tracking large-scale water movement	LEO, SSO	Microwave or laser ranging system	450
SCLP	Snow accumulation for fresh water availability	LEO, SSO	Ku and X-band radars, K and Ka-band radiometers	500
Large Missions ($300–$900 million)				
GACM	Ozone and related gases for intercontinental air quality and stratospheric ozone layer prediction	LEO, SSO	UV spectrometer, IR spectrometer, Microwave limb sounder	600
3D-Winds (Demo)	Tropospheric winds for weather forecasting and pollution transport	LEO, SSO	Doppler lidar	650

*Cloud-independent, high temporal resolution, lower accuracy SST to complement, not replace, global operational high accuracy SST measurement.

Further, the Committee is particularly concerned with the lack of clear agency responsibility for sustained research programs and the transitioning of proof-of-concept measurements into sustained measurement systems. To address societal and research needs, both the quality and the continuity of the measurement record must be assured through the transition of short-term, exploratory capabilities, into sustained observing systems. The elimination of the requirements for climate research-related measurements on NPOESS is only the most recent example of the Nation's failure to sustain critical measurements. Therefore, our committee recommends that the Office of Science and Technology Policy, in collaboration with the relevant agencies, and in consultation with the scientific community, should develop and implement a plan for achieving and sustaining global Earth observations. This plan should recognize the complexity of differing agency roles, responsibilities, and capabilities as well as the lessons from implementation of the Landsat, EOS, and NPOESS programs.

Mr. Chairman, the observing system we envision will help establish a firm and sustainable foundation for Earth science and associated societal benefits through the year 2020 and beyond. It can be achieved through effective management of technology advances and international partnerships, and broad use of satellite science data by the research and decisionmaking communities. Our report recommends a path forward that restores U.S. leadership in Earth science and applications and averts the potential collapse of the system of environmental satellites. As documented in our report, this can be accomplished in a fiscally responsible manner, and I urge the Committee to see that it *is* accomplished.

Thank you for the opportunity to appear before you today. I am prepared to answer any questions that you may have.

The CHAIRMAN. Without objection, the report that you've mentioned will be made part of the record, do you have any objections to that?

Dr. ANTHES. No, I have no objections.*

The CHAIRMAN. Then I thank you very much.

May I now call on the research meteorologist, Mr. Thomas Knutson.

STATEMENT OF THOMAS R. KNUTSON, RESEARCH METEOROLOGIST, GEOPHYSICAL FLUID DYNAMICS LABORATORY, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DOC

Mr. KNUTSON. Thank you, Mr. Chairman.

My name is Tom Knutson, I'm a climate scientist at NOAA's Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey, one of the world's leading climate modeling centers.

I thank the Committee for inviting me to testify today about my experiences as a government scientist, and communicating science to the media. Any opinions I express here are my own, and do not necessarily reflect those of NOAA, or the Department of Commerce.

I have published several papers in leading climate journals on the question of global warming, and hurricanes. I'm a member of a World Meteorologic Organization Committee on Tropical Cyclones and Climate Change. We and our colleagues released a recent assessment statement on this topic, this past December. I am currently on the author team for the CCSP assessment report on *Weather and Climate Extremes in a Changing Climate,* where I and several others are focusing on hurricane aspects.

During my career, at no time have I perceived any interference from NOAA management with my research efforts or scientific publications, such as the *Journal of Climate*.

Concerning my interactions with the media, and with NOAA public affairs in Washington, I will say at the outset that I have had many opportunities to communicate my science to the media over the years. However, among these, I have had just a few opportunities—just a few opportunities—to address a national television audience. There have been some instances where my ability to communicate with the national media has been hindered, or interfered with. I will briefly describe some of these experiences.

NOAA's media policy, issued in June 2004, and its implementation, has led to a number of missed opportunities for interviews at GFDL. In some cases, this was due to the hurdle of needing to obtain prior approval of public affairs people in Washington. I, and several of my colleagues at GFDL have been frustrated by this burden. Some of us believe it has caused reporters to steer away from GFDL scientists for interviews, because of the various hurdles and time constraints.

Several of us at GFDL have had public affairs officers monitor some interviews, typically through phone conferencing. In one case, a public affairs officer traveled from Washington to New Jersey to be in the room with me for a television interview. The impression I had—along with others at GFDL—is that at times, NOAA public

*The information referred to has been retained in Committee files.

affairs was becoming more of an obstruction, than a promoter of interaction between GFDL scientists and the media.

Examples of such interference that either others, or I, experienced included: canceled press releases, requests for interviews that were never responded to, *i.e.,* pocket vetoes, and being given guidelines for steering certain interview questions in directions that were not based on science considerations.

Here are two other specific examples. In October 2005, I received a request to appear on the CNBC program, *On the Money,* where I had appeared several weeks earlier. I contacted NOAA Public Affairs for approval. A few minutes later, I was called by a public affairs person, and was quizzed for several minutes on what I planned to say on the program. I received a voice-mail a few minutes later, informing me that the interview had been turned down.

Internal NOAA e-mails on this incident, obtained later through a FOIA request, are available for review on Congressman Waxman's website.

On another occasion, in Summer of 2005, NOAA Public Affairs had inquired whether I was interested in appearing on a television talk show to discuss global warming and hurricanes. I later received a voice-mail from them, stating, the White House said no.

In response to questions, I detailed these turn-down incidents to a *Wall Street Journal* reporter in February 2006. From the time that Jim Hanson, and later, other scientists and I, went public, I have experienced no further interference that I am aware of, in communicating with the media.

GFDL's unofficial operational practice from shortly thereafter, has been to keep NOAA Public Affairs in Washington informed, but generally, to notify them after the fact, after media contacts. A new draft media policy is being developed at the Department of Commerce, which includes NOAA. I, and others, at GFDL will be anxious to see how NOAA will interpret and implement this new policy.

I think it is important that improved policies be in place to ensure that communication between government climate scientists and the media remain open and free of obstruction.

I appreciate being given the opportunity to testify today. Thank you.

[The prepared statement of Mr. Knutson follows:]

PREPARED STATEMENT OF THOMAS R. KNUTSON, RESEARCH METEOROLOGIST, GEOPHYSICAL FLUID DYNAMICS LABORATORY, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DOC

Introduction

My name is Tom Knutson. I am a climate scientist at NOAA's Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey. I would like to thank the Committee for inviting me to testify today about my experiences as a government scientist in communicating science-related topics to the media. Any opinions I express here are my own, and do not necessarily reflect those of NOAA or the Department of Commerce.

Science Background

I have authored several publications in leading climate science journals on the question of global warming and hurricanes. Most of my career I have worked at GFDL—one of the world's leading climate modeling centers. I am a member of a WMO (World Meteorological Organization) committee on Tropical Cyclones and Climate Change. We developed, in collaboration with a cross-section of the inter-

national tropical cyclone research community, an assessment statement on this topic, which was released this past December. I am currently on the author team for the U.S. CCSP (Climate Change Science Program) assessment report on "Weather and Climate Extremes in a Changing Climate," where I and several others are focusing on hurricane aspects.

My Experiences With the Media and NOAA Public Affairs

During my career, at no time have I perceived any interference from NOAA management with my research efforts or scientific publications in journals such as the *Journal of Climate.* Concerning my interactions with the media and with NOAA Public Affairs in Washington, I will say at the outset that I have had many opportunities to communicate my science to the media over the years. However, among these I have had just a few opportunities to address a national television audience. There have been instances where my ability to communicate with the national media has been hindered or interfered with. I will briefly describe some of these experiences.

A New NOAA Media Policy—2004

NOAA's media policy, issued in June 2004, requires prior notification of Public Affairs before media interviews involving policy relevant research such as mine. This led to a number of missed opportunities for interviews, at times simply due to the additional hurdle and complexity of getting in touch or coordinating with Public Affairs people in Washington (for example evenings and weekends). I and several of my colleagues at GFDL have been frustrated by this burden. Some of us believe it has caused some reporters to steer away from GFDL scientists for interviews because of the various hurdles and time constraints. Reporters are busy and often operate under tight deadlines.

Several of us at GFDL have had Public Affairs officers monitor some interviews, typically through phone conferencing. In one case a public affairs officer traveled from Washington to New Jersey to be in the room with me for a television interview. He did not interfere with the interview.

The impression I had (along with others at GFDL) is that at times NOAA Public Affairs was becoming more of an obstruction than a promoter of interaction between GFDL scientists and the media. Examples of such interference that either others or I experienced included: canceled press releases, requests for interviews that were never responded to ("*i.e.,* pocket vetoes"), and being given guidelines for steering certain interview questions in directions that were not based on science considerations.

Press Release Example

In August 2004, I was asked by NOAA Public Affairs to send them copy of an upcoming paper in the *Journal of Climate* so that a press release could be prepared. I never heard back from them and apparently no press release was issued. Despite this, the *New York Times* learned about the upcoming paper and ran a story on it that generated considerable media interest and more interviews.

On the Term "Global Warming"

In Summer 2005, I was invited by the American Meteorological Society (or AMS) to give a talk here on Capitol Hill on my research. I followed NOAA procedures for this type of appearance, sending my PowerPoint presentation to Legislative Affairs for review several days prior to my talk. I received e-mail expressing some concern with my use of the term "Global Warming" in the title. I did not make any changes, and a few days later received e-mails indicating that the term would be OK for my particular talk. (By that time seminar announcements advertising a talk on "hurricanes in a warming world" had already been released on the Internet by the AMS.)

Two "Turned Down" National TV Appearances on "Global Warming and Hurricanes"

Later that summer, returning from vacation, I listened over the weekend to a voice-mail from NOAA Public Affairs inquiring about whether I would be interested in appearing on a television talk show involving Ron Reagan, Jr., to discuss hurricanes and global warming. A second voice-mail came from a "booker" for the show. As it was the weekend, I responded to the booker's cell number and agreed to make myself available for taping on Monday, providing the appearance was approved by Public Affairs. Arriving at my office on Monday morning, I listened to a new voice-mail from Public Affairs advising me something to the effect of: "Tom, sorry for the confusion . . . . The White House said no . . ."

On October 19, 2005, I received a media request to appear on the CNBC program "*On the Money*" where I had appeared several weeks earlier. I contacted NOAA Public Affairs for approval. A few minutes later I was called by a Public Affairs person

and was quizzed for several minutes on what I planned to say on the program. I was asked whether I thought there was a trend in Atlantic hurricane activity. I gave a guarded response that, based on recently published work, there was some possibility that a trend was emerging. I received a voice-mail a few minutes later informing me that "About the CNBC interview tonight, I'm afraid it has been turned down." Internal NOAA e-mails on this incident, obtained later through a FOIA request, are available for review on Congressman Waxman's website: *http://oversight.house.gov/story.asp?ID=1107&Issue=Politics+and+Science*

Some months later I learned that I have the right as a private citizen to talk to the media on my own time, and in principle I could have tried to use this tactic to circumvent NOAA's "turn down" (assuming a media organization would actually agree to go along.)

In response to questions, I detailed these "turn-down" incidents to a *Wall Street Journal* reporter for a Feb. 16, 2006 article.

Aftermath of Going Public

From the time that Jim Hansen, and later other scientists and I, went public, I have experienced no further interference that I am aware of in communicating with the media. GFDL's unofficial, operational practice, shortly thereafter, has been to keep NOAA Public Affairs in Washington informed, but generally notify them after the fact about media contacts.

One later incident that I was tangentially involved with was the several-month hold-up, apparently somewhere in the Department of Commerce, of a NOAA FAQ sheet on Atlantic hurricanes and climate that others and I at NOAA had helped to put together. More detail on that incident is presented in a *Nature* article dated Sept. 28, 2006.

Moving Forward

In summary, prior to going public with these incidents, I experienced some cases of what I view as unreasonable levels of interference with my communication with the media. Requirements such as prior notification of Public Affairs have hindered GFDL scientists' communications with the media. A promising development is a new draft media policy being developed in the Department of Commerce, which includes NOAA. I and others at GFDL will be anxious to see how NOAA will interpret and implement the new policy. I think it is very important that such improved policies be in place to ensure that the channels of communication between government climate scientists and the media and public remain open and free of obstruction.

I appreciate being given the opportunity to testify today. Thank you.

The CHAIRMAN. Thank you very much, Mr. Knutson.

And may I now call upon Dr. James Mahoney, Environmental Consultant.

STATEMENT OF JAMES R. MAHONEY, PH.D., ENVIRONMENTAL CONSULTANT

Dr. MAHONEY. Thank you, Mr. Chairman.

I assume this is still on? Am I transmitting OK?

Thank you, Chairman Inouye, and Vice Chairman Stevens, and other Members of the Committee. I appreciate your invitation to address the Committee today.

I am James R. Mahoney, and I currently serve as an Environmental Consultant, but I wanted to identify that from 2002 until 2006, the specific dates are in my written testimony, I was Assistant Secretary of Commerce, and Deputy Administrator of NOAA, and I was also a Director of the Climate Change Science Program during its first four, formative years.

I reluctantly retired from my Federal appointment about 10 months ago because of continuing, significant health problems, so I am now speaking as an individual, but where appropriate, I try to draw on the information that I developed during my time in my position.

I received a Ph.D. degree in meteorology from MIT, with a specialization in geophysical fluid dynamics, a specialization that Mr. Knutson has furthered much more over the years of his own career.

In response to the Chairman's letter, I address three main topics today. One, the evolution of NOAA's scientific communication policy; two, the peer-review process required for reports to be officially released by NOAA, and; three, other relevant items. And I have chosen that third category "other relevant items" to provide a little highlight/background on the Climate Change Science Program, because we have developed a very special approach to transparency and review, which I think is serving the science field, and especially the Nation, very well.

I appear today in the hybrid position I mentioned a minute ago. I have knowledge from my time in Federal appointment, but I am now a private citizen. Relative to the broader issue of scientific integrity, I certainly rely on my experience and judgment developed in more than 40 years as a working scientist in environmental management, including earlier experience as Director of the Federal Acid Rain Assessment Program back in the 1980s.

NOAA has a long and well-recognized culture aimed at fostering integrity in scientific communication activity. I suggest, for the Committee's interest, a definition of communication activities that includes several parts, this is laid out in my testimony. For time limits, I will just name them—at the highest level, I see the scientific synthesis documents that bring things together, like we have in the Climate Change Science Program, and like the international body has with the IPCC reports, as you know, a good example being the new *Fourth Assessment Summary,* which was released last week.

After that special synthesis material, which is of the most, hopefully, the most importance and relevance to the Nation, and to this Committee's work, are the general rung of important peer-reviewed scientific papers. The peer-review is the highest standard for normal contribution of papers to be well recognized.

Next, the scientific papers that are presented at meetings, verbally, and often in written form, but often without peer-review. Then, books and monographs, then various project summaries, and then on down to the case of informal presentations that may include school lectures, other community events, and matters of this sort.

I mention these at the outset, with reference to that highest standard, and suggest that that highest standard of aggressive and transparent review—and inclusive review by all of the interested constituencies—are the measures most appropriately applied to the CCSP reports, which set out to give us the best look at this information, as well as the IPCC assessments, as with the current fourth one now coming along.

I note that there are thousands of NOAA scientists working, and they produce several thousand scientific communications each year. Moreover, the NOAA Public Affairs Offices around the country typically field approximately 20 to 50 different media inquiries each day. So, this question of communications is a very broad one, which carries on almost all of the time.

NOAA's communication policy is aimed at reducing or eliminating errors, and that is the policy that, and the standard that we should be held to.

Some NOAA scientists have complained about alleged muzzling of some of their activity, Mr. Knutson has just spoken about this, and NOAA has taken several steps to address this. As Dr. Brennan said before, Administrator Lautenbacher has written to all NOAA employees twice about this, and I know that the Department of Commerce is currently revising its communication policy, and I have great hope that it will clarify some, any remaining difficulties.

The peer-review process at NOAA, I would refer to the same six categories, beginning with synthesis products, other peer-reviewed papers, and on down the line, and I simply recommend to the Committee that the six-part table that I have presented, or any other similar grouping—I'm not claiming special status for my six, but the concept of understanding the different types of communications, I recommend to the Committee for its use in reviewing the different approaches to peer-review in various cases.

Now, I'll finish with a couple of comments about the CCSP Program. Dr. Brennan has already addressed this, so I will simply note that when we prepared the CCSP Strategic Plan to guide the development of our Synthesis and Assessment documents, we asked the National Academy of Sciences to conduct two, separate reviews of that work. The first at a draft stage, and the second review after the plan was fully completed. The Academy found that plan to be an ideal tool for guiding the Nation's climate studies throughout the upcoming years. And we have tried very hard to use this as the basis for the work in the CCSP Program.

I'll just mention before closing that the analyses carried out in the CCSP studies have been aimed at the most challenging scientific question, so we get the best view and guidance. We address those questions, we address the stakeholders, we attempt to look at uncertainties, but with the maximum transparency for all viewers, and reviewers, and I cite this as some of the major progress which has been achieved in the last few years.

With that, Mr. Chairman, and Mr. Vice–Chairman, I end my testimony. I'd like to add just the—what I'll call a professional comment at the end. I believe that there is abundant evidence about the human causation of climate change about which you began this hearing today. I also believe that the working scientists have very important contributions to make in this area, and I strongly favor the theme you have addressed for this hearing.

Thank you, Mr. Chairman, Mr. Vice Chairman.

[The prepared statement of Dr. Mahoney follows:]

PREPARED STATEMENT OF JAMES R. MAHONEY, PH.D., ENVIRONMENTAL CONSULTANT *

Chairman Inouye, Vice Chairman Stevens and Members of the Committee: thank you for your invitation to address the Committee today on the important issue of assuring integrity in climate change research. I am James R. Mahoney, and I currently serve as an Environmental Consultant, providing scientific and professional

* Previously (April 2, 2002–March 30, 2006): Assistant Secretary for Oceans and Atmosphere, U.S. Department of Commerce; Deputy Administrator of the National Oceanic and Atmospheric Administration; and Director, U.S. Climate Change Science Program.

advice to a number of organizations. From April 2, 2002 to March 30, 2006, I was Assistant Secretary of Commerce for Oceans and Atmosphere, and Deputy Administrator of the National Oceanic and Atmospheric Organization (NOAA). During this period I was also the Director of the U.S. Climate Change Science Program (CCSP), involving 13 Federal agencies conducting and overseeing total annual budgets of approximately $2 billion dedicated to scientific research, Earth system observations, computer simulations of future climate conditions, and evaluation of possible adaptation and mitigation actions to address climate change. I reluctantly retired from my Federal appointment approximately 10 months ago because of continuing, significant health problems.

In 1966 I received the Ph.D. degree in meteorology from MIT, with a specialization in geophysical fluid mechanics. Since that time I have had over 40 years continuous experience in science-based environmental management, including service on the faculty of Harvard University, advisory assignments with national government agencies and international organizations in several regions of the world, extensive private sector environmental assessment and design work, and two appointed positions with the U.S. Federal Government (involving overall management of national acid rain studies from 1988 to 1991, and climate science studies from 2002 to 2006).

In response to the issues raised in Chairman Inouye's letter, my testimony today addresses three main topics: (1) the background and evolution of NOAA's communication policy related to scientific research; (2) the peer-review process required for scientific reports or conclusions to be officially released by NOAA; and (3) other important and relevant items. Related to this final topic, I address the scientific and general public review process required for scientific reports and conclusions being released by the Climate Change Science Program. These CCSP processes are highly important for assuring the credibility of complicated and often controversial climate science findings that, in turn, underpin the development of appropriate climate change policies that will be needed in the years and decades ahead to address regional-, national-, and international-scale challenges.

I appear today in somewhat of a "hybrid position". In the case of positions developed and actions taken during the recent 4 years (ending on March 31, 2006) while I served in my Federal appointed assignments, I attempt to speak from the perspective of my former position, and to convey the requested information based upon my memory and personal files, augmented by recent dialog with a limited number of my former colleagues. In the case of the broader issue of scientific integrity involved in the reporting of controversial environmental research, I also rely on the experience and judgment I have developed during more than 40 years of environmental study. As an example, I benefited from the development of a large body of "lessons learned" during my years as Director of the interagency National Acid Precipitation Assessment Program, from 1988 to 1991. Many lessons developed in the process of applying acid rain research findings to Federal legislation (for example, to the Clean Air Act Amendments of 1990) positively influenced my commitment to highly transparent and inclusively reviewed scientific statements related to climate change.

The Background and Evolution of NOAA's Communication Policy Related to Scientific Research

As one of the principal scientific agencies within the Federal Government NOAA has long had a well-recognized culture aimed at fostering integrity in its scientific communications activities. I suggest for the Committee's interest a working definition for "communications activities" to include (1) scientific synthesis documents (often co-authored by multiple experts) intended to summarize the best available "state of the science" in defined areas of coverage; (2) peer reviewed research papers appearing in recognized scientific journals; (3) verbal (and often written) scientific papers presented at scheduled scientific meetings; (4) books, monographs and/or sections of books intended to summarize science in designated subject areas; (5) program and project report documents that provide examples (but not exhaustive summaries) of interesting developments in the areas studied; and (6) informal presentations to students, community groups, *etc*.

This list of six categories is ranked in the order of decreasing requirements (in my view) for thorough and formal review before dissemination. Examples of Category 1 include the Synthesis and Assessment Reports (SAR's) being prepared by the Federal Government sponsored Climate Change Science Program (discussed further below), and the several volumes of the United Nations sponsored Fourth Assessment Report (FAR) being prepared by the Intergovernmental Panel on Climate Change (IPCC) that released last week its new Summary for Policymakers for the Working Group I (Physical Science findings). Both the CCSP and the IPCC documents are being prepared following well-established protocols to assure comprehensiveness, transparency and broad review by interested constituencies.

In the case of NOAA's scientific communications (including all six categories mentioned above) it is important to note that thousands of NOAA scientists produce several thousand scientific communications each year. Even in the category of media inquires NOAA typically receives twenty to fifty press inquiries each workday. The normal scientific culture of carefully reporting the findings of studies has served NOAA and other Federal scientific agencies well for many years—in most cases. My observation is that—in all large workforces—there will always be some small percentage of errors in communication. Many of these errors are inadvertent, and can usually be rectified quickly. My personal observation is that there are occasional "intended errors" or misrepresentations that can occur within any organization and that illustrate the need for effective communications policies applicable to government scientific organizations. These situations can arise from two causes: (1) a scientist may desire to claim disproportionate credit for his/her work, or (2) the bias of a scientist (or a group of scientists) may lead to inaccurate reporting or discussion of findings.

NOAA's communication policy over several years has aimed to reduce or eliminate errors and misrepresentations by: (1) assuring appropriate internal scientific reviews before technical information is communicated; (2) asking scientists to coordinate their communication activities with the public affairs offices in the major elements of NOAA (to avoid "left hand—right hand" inconsistencies among various researchers). Please note that the internal scientific reviews mentioned here are to be conducted by scientific peers, and not by political appointees.

During recent years some scientific issues (climate change in particular) have become very controversial among elements of the public, and this has created increased challenges to the integrity of scientific reporting by NOAA and other agencies. In this situation of heightened sensitivity some NOAA scientists have complained about alleged "muzzling" of their ability to speak to the media. In particular, NOAA's long-term practice of using its public affairs specialists to seek consistency among the reports by various scientists has been seen as an impediment to full reporting. NOAA has been taking several steps to address this concern since it has arisen. In particular, NOAA Undersecretary Lautenbacher has written to all NOAA employees twice during the past year affirming his support for open reporting by all NOAA scientists. Moreover I understand that the Department of Commerce (DOC) has been revising its communications policy to encourage, but not require, scientists to work with their counterparts in Public Affairs prior to dissemination. I understand that this revised policy should be ready for adoption within the next few weeks. It is my view that this revised policy should resolve most or all of the recent complaints by some NOAA scientists, and I am sure that if any further issues arise, they will be addressed promptly by NOAA management.

The Peer-Review Process Required for Scientific Reports or Conclusions to Be Officially Released by NOAA

In response to this question, I refer to the six categories of "communications activities" that I previously recommended for consideration. Not all of these categories represent "official releases" by NOAA, so it is important to recognize the differences between the categories. *Table 1* on the next page addresses each category.

As *Table 1* illustrates, the scientific Synthesis and Assessment Reports (for example, the 21 CCSP Synthesis and Assessment Reports) represent an example of the most stringent requirements for peer review, including the opportunity for comments by interested public constituencies as well as by members of the scientific community. The IPCC *Fourth Assessment Report* documents (such as the physical science *Summary for Policymakers* released last week) are similar examples. A large number of NOAA scientists, as well as many U.S. Government scientists from other agencies took part in the preparation of the new IPCC document. Dr. Susan Solomon of the NOAA Boulder Laboratories served as the overall Co-Chairman of IPCC Working Group I, providing substantial leadership to this major international activity.

Table 1. Classification of Categories of Scientific Information Communication Suggested to the Senate Committee by James R. Mahoney
(These classifications are not used in the NOAA Communication Policy)

Category	Topic	Official Release?	Comments
1	Scientific synthesis documents	Yes	Requires extensive peer and public review
2	Peer-reviewed research papers	Case-by-case determination	Peer review accomplished by the publishing journal and by NOAA
3	Papers presented at meetings	Usually not	Peer review by NOAA scientific staff
4	Books & monographs	Case-by-case determination	Peer review by NOAA scientific staff
5	Program & project report documents	Yes	Peer review by NOAA scientific staff & project management
6	Lectures to students & other groups	No	Peer review by NOAA scientific staff is encouraged

As the table illustrates, other communications activities routinely undertaken by NOAA scientific staff typically have differing requirements for peer review. All of the first five categories require at least peer review by other NOAA scientific staff (*i.e.,* independent review by expert staff not involved in the drafting of the information) before dissemination or other use of the information. The sixth category (informal lectures to students and other community groups) does not require peer review in all cases because the information conveyed in such lectures usually would not constitute an official dissemination by NOAA.

I recommend that the Committee keep in mind the six-part table presented here, or a similar classification scheme, when considering the manner in which NOAA (and possibly other Federal science agencies) conveys technical information to the scientific community, to students, and to interested constituencies among the general public.

The Scientific and General Review Process of the CCSP Scientific Synthesis and Assessment Products

In June 2001 the President called for an increase in Federal funding for climate research and observations, as part of his overall plan (also including control technology development and major new international technical collaboration) to address climate change issues. A major part of the reasoning for increased climate research was the need to improve the accuracy of regional and global scale understanding of climate variability, and to improve projections of future climate conditions related to profiles of future greenhouse gas emission rates around the world. In February 2002 the President created a new, cabinet-level interagency management structure to supervise the approximately $2 billion annual Federal expenditure in climate research and monitoring. After confirmation by the Senate in late March 2002, I undertook my new position as CCSP Director on April 2, 2002. The earliest focus for the new CCSP management structure was the creation of a Strategic Plan that would assure the development and dissemination of the best available scientific syntheses of high-priority climate issues.

The CCSP Strategic Plan, which has guided both scientific reporting and the development of improved assessment methodologies, was adopted in July 2003 after extensive peer review, public review and special review by an *ad hoc* committee of the National Academy of Sciences convened at the request of CCSP. The National Academy conducted a second round review of the newly revised CCSP Strategic Plan in late 2003, and reported its finding that the Plan constituted a good vehicle to guide the development of the Nation's climate studies throughout the next decade.

The CCSP Strategic Plan required the development of detailed, aggressive plans for scientific peer review, and comprehensive public review, of the scientific Synthesis and Assessment Reports by CCSP. The review process was complicated by the passage of the Information Quality Act of 2002 and the adoption of separate guidelines to comply with the Act by OMB between 2003 and 2005. In 2005 CCSP published its *Guidelines for Producing CCSP Synthesis and Assessment Products,* incorporating the combined requirements of the CCSP Strategic Plan and the OMB Guidelines responsive to the 2002 Information Quality Act. The detailed guidelines for the CCSP products are available on the CCSP website *www.climatescience.gov*,

and are being used as the basis for extensive peer and public review of the entire set of 21 CCSP Synthesis and Assessment Reports currently being prepared. These guidelines represent one of the most comprehensive summaries of guidance for the preparation and review of important government science documents. I commend these guidelines to the Committee and its staff, both to evaluate the approach to scientific dissemination adopted by CCSP, and to provide examples that may be useful for other government science reporting as well.

Time does not allow detailed discussion of these CCSP guidelines, but I note the summary statement of principles for the guidelines for the interest of the Committee. These general principles are:

- Analyses structured around specific questions.
- Early and continuing involvement of stakeholders.
- Explicit treatment of uncertainties.
- Transparent public review of analysis questions, methods and draft results.
- Adoption of a "lessons learned" approach, building upon the ongoing CCSP analyses.

I cite one example of the major progress attained by the CCSP collaborating agencies during the past few years, by reference to the IPCC Fourth Assessment science summary released last week: When the prior IPCC Third Assessment was released in late 2000, the large computer models used for the future projections of global climate conditions were supplied by Canadian and European research institutes, because the U.S. climate modeling capability was not ready for use in these global studies. In the new 2007 IPCC assessment, my view (shared by many in the field) is that the United States has assumed the leadership position in the critically important computer modeling of future climate conditions for the global climate science community.

To the Vice Chairmen and Members of the Committee, I thank you for your invitation to appear before the Committee today. I shall be pleased to answer any questions you choose to pose.

The CHAIRMAN. Thank you very much, Dr. Mahoney.

And I'll now call on the Director of Climate Science Watch, Government Accountability Project, Mr. Rick Piltz.

STATEMENT OF RICK PILTZ, DIRECTOR, CLIMATE SCIENCE WATCH, GOVERNMENT ACCOUNTABILITY PROJECT

Mr. PILTZ. Thank you, Mr. Chairman, Mr. Vice-Chairman, Members of the Committee. I greatly appreciate the opportunity to present testimony at this hearing.

In my written testimony, I address several issues that I believe are of particular significance for Congressional oversight at this time. Very briefly, a few key points.

First, on the Administration's suppression of the *National Assessment of Climate Change Impacts:* In the 1998 to 2000 timeframe, the Federal Global Change Research Program initiated, pursuant to the Global Change Research Act, a project to assess the potential consequences of climate variability and change for the United States. A multi-agency coordination effort supported assessment activities involving hundreds of scientists and stakeholders in 19 regions around the country, including the Pacific Islands, Alaska, the Gulf Coast, the Mid-Atlantic, and others.

In November 2000, an independent synthesis panel made up of leading scientists and other experts, issued the *National Assessment* report that—to this day—remains the most comprehensive, scientifically-based assessment of the potential consequences of climate change for the United States. The National Assessment was designed to become an ongoing process to support national preparedness in dealing with global climate change.

But the Bush Administration abandoned support for this process of communication between scientists and stakeholders, and has failed to move forward with a follow-on National Assessment report.

The Administration has suppressed discussion and use of the National Assessment Report by Federal agencies in research and assessment activities, and has suppressed references to it in published program documents, including annual program reports to Congress, that for 9 years, I edited while working for the Climate Change Research Program.

It is my understanding that the White House, through the agency of the Council on Environmental Quality, directed this suppression, which was then implemented by the CCSP leadership during the last 5 years.

Myron Ebell, of the industry-funded policy group the Competitive Enterprise Institute, has been quoted as saying, "To the degree that it is vanished, we have succeeded." And the fact that the Administration and the CCSP leadership essentially made the National Assessment vanish, in the Strategic Plan for the U.S. Climate Change Science Program, issued in 2003.

The National Research Council has used and praised the National Assessment as an important and credible study, and was critical of the program's unjustified failure to incorporate and build on the National Assessment in its Strategic Plan.

The White House Science Office, the Council on Environmental Quality, and the CCSP leadership stonewalled the Academy by failing to respond to and address this criticism, by providing any justification for their actions, scientific or otherwise.

I see the Administration's treatment of the 2000 National Assessment as the political interference with scientific integrity that has done, and continues to do, the greatest damage in undermining national preparedness in dealing with the challenge of global climate change. I believe it would be appropriate for the Committee to investigate this, and even more important, for Congress to move to revitalize what should become an ongoing National Assessment process. High-level support for this kind of direct, unfiltered communication between scientists and stakeholders, would convey important information to policymakers and society about climate change impacts, and potential response strategies.

Also, the Administration has acted in a variety of ways to impede and manipulate communication about climate change by Federal scientists to wider audiences, including Congress and the media. And it's not so much interference with what's published in the technical journals, but it's when the science comes forward and is communicated to a wider audience—Congress, the media, the public—that the political gatekeepers step in, through a variety of mechanisms.

Last week, the Union of Concerned Scientists and the Government Accountability Project released their joint report, *Atmosphere of Pressure.* This report—investigation—uncovered new evidence of widespread political interference in Federal climate science. One hundred and fifty Federal climate scientists reported, collectively, at least 435 such incidents of political interference during the past 5 years. More than 100 survey respondents reported changes or

edits during review of their work, to change the meaning of their findings. That number should be zero.

Political interference in climate science has moved from the anecdotal to the epidemic. And even if we succeed in lifting this heavy hand of censorship, there is still the problem of getting the political leadership to embrace the findings that are put forward by the scientists, and act on them to translate them effectively into National policy.

This atmosphere of pressure that we have been seeing has serious consequences for the Nation's ability to have access to the best available scientific information for understanding and responding to climate change. The UCS/GAP report has a set of recommendations, that ensure basic freedoms for government scientists, and that taxpayer-funded science sees the light of day, without manipulation of climate science communication by political gatekeepers.

Congress should act to extend whistleblower protection to scientists who report interference. Federal scientists have a constitutional right to talk about any subject, so long as they speak as a private citizen, and the public has the right to hear them.

A case example of my own personal experiences with what I consider inappropriate White House political interference with Climate Change Science Program reports produced by career Federal science professionals is summarized and explained in my written testimony.

I'll conclude on that. I'd be pleased to answer any questions.

If I could just add one additional item. Dr. Brennan referred to the U.S. Climate Change Science Program budget as $2 billion. In fact, it was $2 billion in 2004. But the Administration has steadily cut back the funding for climate change research, to the point where, in the President's Fiscal Year 2008 request the other day, that budget request is now $1.5 billion. That is an almost 30 percent cut in real terms in the climate research budget in 4 years, and almost all of that can be accounted for by cutbacks in the global climate observing system—the NASA/NOAA observing system, which is in a state of crisis. Dr. Anthes has addressed that, I address it also in my written testimony, but I urge the Committee to look into this. I think it's a tremendously important issue for oversight, and to be rectified by Congressional action.

Thank you.

[The prepared statement of Mr. Piltz follows:]

PREPARED STATEMENT OF RICK PILTZ, DIRECTOR, CLIMATE SCIENCE WATCH, GOVERNMENT ACCOUNTABILITY PROJECT

Chairman Inouye, Vice Chairman Stevens, members of the Committee—I greatly appreciate the opportunity to present testimony at this hearing, which addresses a subject of crucial importance for good policymaking and an informed society. I am currently the Director of Climate Science Watch, a program of the Government Accountability Project in Washington, D.C. The Government Accountability Project, a 29-year-old nonprofit public interest group, is the Nation's leading whistleblower protection organization. Climate Science Watch engages in investigation, communication, and reform advocacy aimed at holding public officials accountable for how they use climate research in addressing the challenge of global climate change.

Since 1988, my primary professional focus has been on the relationship between science and policy on global climate change.[1] From April 1995 until March 2005, I worked in the program coordination office of the multiagency U.S. Government program that supports scientific research on climate and associated global change.[2] The program was originally established as the U.S. Global Change Research Program (USGCRP) under the Global Change Research Act of 1990. In 2002, the Bush Administration established the U.S. Climate Change Science Program (CCSP), incorporating the USGCRP and the President's Climate Change Research Initiative.

Key Issues Addressed in My Testimony

We currently face major, interrelated problems with the U.S. Climate Change Science Program and with how the Administration is undercutting climate science assessment, communication, and research. In my judgment, the following are of particular significance for the public interest and for Congressional oversight at this time:

1. The Administration suppressed official use of the National Assessment of Climate Change Impacts and has failed to continue the National Assessment process, thus undermining national preparedness for dealing with the challenge of global climate change.
2. The Administration has acted in a variety of ways to impede and manipulate communication about climate change by Federal scientists and career science program leaders to wider audiences, including Congress and the media.
3. The Administration has cut the climate change research budget to its lowest level since 1992 and is presiding over what appears to be a growing crisis in the global climate observing system, thus undermining a critical national intelligence-gathering process.

My testimony deals with each of these problems and concludes with a set of recommendations.

1. The Administration Suppressed Official Use of the National Assessment of Climate Change Impacts and Has Failed to Continue the National Assessment Process, Thus Undermining National Preparedness for Dealing With the Challenge of Global Climate Change

During the 2001–2005 time-frame, I came to the conclusion that politicization of climate science communication by the current Administration was undermining the credibility and integrity of the Climate Change Science Program in its relationship to the research community, to program managers, to policymakers, and to the public interest. Among the key issues that I viewed as particularly significant in the politicization of the program, foremost was the treatment by the current Administration of the *National Assessment of the Potential Consequences of Climate Variability and Change* ("National Assessment").

The National Assessment to this day remains the most comprehensive, scientifically based assessment of the potential consequences of climate change for the United States. No national climate change assessment process or reporting of comparable subject matter and regionally-based, nationwide scope has subsequently been undertaken with the support of the Federal Government. The National Assessment was a pioneering experiment in societal relevance for climate change research.

I see the Administration's treatment of the 2000 National Assessment, and the abandonment of high-level support for an ongoing process of scientist-stakeholder interaction, as the central climate science scandal of the Administration—the action that has done, and continues to do, the greatest damage in undermining national

[1] I studied Political Science at the University of Michigan, earning an M.A. and Ph.D. Candidate status. I have worked on issues of environmental and energy research and policy both inside and outside of government since 1979. From 1991 through 1994 I served as a Majority Professional Staff Member of the Committee on Science, Space and Technology of the U.S. House of Representatives. During that time I supported the Committee's oversight of climate and global change research and policy issues.

[2] The Climate Change Science Program Office, where I worked, supports this research effort by performing interagency coordination, strategic planning, communications, and reporting functions, and serving as the program secretariat. I worked directly with the program leadership, career Federal science program managers, and the senior professional staff in the program office. At the time I resigned in March 2005 my position was Senior Associate. During the time I worked in the program office I was employed by the University Corporation for Atmospheric Research (UCAR), based in Boulder, Colorado. UCAR is a nonprofit consortium of North American member universities that grant doctoral degrees in the atmospheric and related sciences. I was assigned to work in the program office under a grant from the National Science Foundation to the UCAR Joint Office of Science Support.

preparedness in dealing with the challenge of global climate change. Thus, I believe it would be appropriate for the Committee to investigate the Administration's treatment of the 2000 National Assessment, as part of oversight of the White House's political intervention in the U.S. Climate Change Science Program and in particular its assessment and communication activities.

The National Assessment was initiated, carried out, and published between 1997 and 2000, during the time I worked in the program office. The Global Change Research Act of 1990 mandates the production and submission to the President and the Congress "no less frequently than every 4 years" scientific assessment reports of global change that include the impacts of such change on the environment and on various socioeconomic sectors. To be responsive to this statutory mandate, the program sponsored the National Assessment. The process involved communication between scientists and a variety of "stakeholders," from the public and private sectors and academia. It was intended to initiate a process of interaction and reporting that would be ongoing and developed and improved over time.

A National Assessment Synthesis Team made up of leading scientists and other experts, was established as a Federal advisory committee to guide the process. It produced a National Assessment report that integrated key findings from regional and sectoral analyses and addressed questions about the implications of climate variability and change for the United States. The report was forwarded to the President and Congress in November 2000.

Climate change impacts vary by region and sector, as do response strategy options. University-based teams led 19 regional workshops and assessments across the United States that focused on interrelated environmental and socioeconomic issues. In addition, five sectoral reports focused on issues that were national in scope and related to the goods and services on which society and the economy depend, including reports on agriculture, water, human health, forests, and coastal areas and marine resources.

Every Member has an interest in the kind of information such an assessment can make available for consideration in developing national policy. These were groundbreaking, integrative efforts that were designed to be of use to Congress and the Federal agencies, state and local officials, regional and sectoral planners and resource managers, educators, and the general public. They exemplified a vision of a democratic process for societally relevant environmental assessment, based on dialogue between interdisciplinary teams of scientific experts and a wide range of stakeholders and the general public. Through this process, the agenda for ongoing research and assessment would be informed by a better understanding of the concerns of policymakers and the public, and policymakers and the public would learn about issues of climate change and its potential consequences so as to better equip them for making decisions.

In June 2001, the Committee on the Science of Climate Change of the National Research Council (NRC) issued a report titled *Climate Change Science: An Analysis of Some Key Questions.* The study originated from a White House request in May 2001 to help inform the Administration's review of U.S. climate change policy. The Committee was made up of 11 eminent climate scientists. It was chaired by Ralph J. Cicerone of the University of California, who is today the President of the National Academy of Sciences. The section of the NRC report on "Consequences of Increased Climate Change of Various Magnitudes" is based almost entirely on the findings of the National Assessment. The NRC Committee did not in any way call into question the scientific legitimacy or significance of the National Assessment, but rather drew on it as a core text in this advisory report to the White House.

The Administration's Treatment of the National Assessment

Despite the utility of the National Assessment, the Administration, most aggressively from the second half of 2002 onward, acted to essentially bury the National Assessment, *i.e.,* by suppressing discussion of it by participating agencies for purposes of research planning by the Climate Change Science Program; suppressing references to it in published program documents including annual program reports to Congress; withdrawing support from the coordinated process of scientist-stakeholder interaction and assessment that had been initiated by the first National Assessment; and making clear that no second National Assessment would be undertaken. The Administration failed to consider and utilize the National Assessment in the *Strategic Plan for the U.S. Climate Change Science Program* issued in July 2003. From my experience, observation, analysis of documentation, and personal communications with others in the program, I believe it is clear that the reasons for this were essentially political, and not based on scientific considerations. I believe this is generally understood within the program.

In late May 2002 the Administration issued the report *U.S. Climate Action Report 2002: Third National Communication of the United States of America Under the United Nations Framework Convention on Climate Change.* This *Climate Action Report* was one of a series of reports required periodically pursuant to U.S. responsibilities under the Framework Convention on Climate Change, the foundational climate treaty. Chapter 6 of the *Climate Action Report,* "Impacts and Adaptation," drew substantially on the findings of the National Assessment for its discussion of the potential consequences of climate change for the United States. This was appropriate, considering that the National Assessment had recently been published and represented the most systematic, in-depth study of this subject that had been done to that point (and remains so at the present time).

The "Impacts and Adaptation" chapter prompted press coverage, including a prominent story in the *New York Times,* on how the chapter suggested a new acknowledgement by the Administration of the science pointing to the reality of human-induced climate change and a range of likely adverse societal and environmental consequences. This appeared to cause a public relations problem for the Administration. Asked about the report and the press coverage of it, the President replied in a way that distanced himself from it by referring to it as "a report put out by the bureaucracy."

My understanding at that point, which I believe was coming to be more widely shared, both inside and outside the program, was that the Administration was uncomfortable with the mainstream scientifically based communications suggesting the reality of human-induced climate change and the likelihood of adverse consequences. Straightforward acknowledgement of the growing body of climate research and assessment suggesting likely adverse consequences could potentially lead to stronger public support for controls on emissions and could be used to criticize the Administration for not embracing a stronger climate change response strategy. It was the concern about this linkage that seemed to underlie much of what I perceived to be the Administration's intervention in managing communications by the Climate Change Science Program.

In this context, for the Administration to have released a *U.S. Climate Action Report* with a chapter on climate change impacts that identified a range of likely adverse consequences, based on scientific reports including the National Assessment, could rightly be seen as an anomaly and appeared to be seen as a significant political error by Administration allies dedicated to denying the reality of human-induced global warming as a significant problem. On June 3, 2002, Myron Ebell of the Competitive Enterprise Institute sent an e-mail message addressed to Philip Cooney, Chief of Staff at the White House Council on Environmental Quality (CEQ), offering to help manage this "crisis" and help "cool things down." (This document was obtained by a nongovernmental organization via a Freedom of Information Act request). In the e-mail to Cooney, Ebell said: "If it were only this one little disaster we could all lock arms and weather the assault, but this Administration has managed, whether through incompetence or intention, to create one disaster after another and then to expect its allies to clean up the mess." He told Cooney the Administration needed to get back on track with disavowals of the *Climate Action Report* and the National Assessment. Shortly thereafter, Cooney began to play a more visible role in Climate Change Science Program governance as the CEQ liaison to the interagency principals committee, and in intervening to manage and edit Climate Change Science Program communications.

Immediately prior to taking the position of CEQ Chief of Staff, Cooney had been employed as a lawyer-lobbyist at the American Petroleum Institute (API), the primary trade association for corporations associated with the petroleum industry. He was the climate team leader at API, leading the oil industry's fight against limits on greenhouse gas emissions. CEI also had a close relationship with the oil industry, having reportedly received $2 million in funding between 1998 and 2005 from ExxonMobil.

In July 2003 the program issued its *Strategic Plan for the Climate Change Science Program.* The document was submitted to Congress under the signatures of Secretary of Energy Spencer Abraham, Secretary of Commerce Donald L. Evans, and Office of Science and Technology Policy Director John H. Marburger. In the plan, the existence of the National Assessment was mentioned only in a single sentence, which did not even include the title of the report. There was no description of the structure, process, scope, purpose, or contents of the National Assessment. The National Assessment did not appear in the bibliography of the plan. No information was given to suggest how copies might be obtained. In effect, mention of the National Assessment had almost completely vanished from the CCSP Strategic Plan.

National Research Council's Criticism of the CCSP on the National Assessment

The final report of the National Research Council's Committee to Review the U.S. Climate Change Research Program Strategic Plan, issued in February 2004, was critical of the failure of the program to incorporate and build on the National Assessment in its Strategic Plan for assessment and "decision support" activities. On the subject of the National Assessment's scientific credibility the report said:

> It is especially important that CCSP synthesis and assessment products be independently prepared, or evaluated, by the science community. This will provide a level of credibility that reports produced exclusively within the government sometimes fail to achieve. The only previous centralized assessment effort by the CCSP agencies, the U.S. *National Assessment on the Potential Consequences of Climate Variability and Change,* followed these credibility assurance guidelines. The National Assessment's Overview and Foundation reports are important contributions to understanding the possible consequences of climate variability and change. (National Research Council, Committee to Review the U.S. Climate Change Science Program Strategic Plan, *Implementing Climate and Global Change Research: A Review of the Final U.S. Climate Change Science Program Strategic Plan* (National Academies Press, 2004, p.13).

On the value of the National Assessment's process of engaging scientists and "stakeholders" in dialogue, the NRC review said:

> The processes of stakeholder engagement and transparent review of the National Assessment reports were exemplary. . . . The Strategic Plan . . . should more effectively buildupon a growing capability within the U.S. climate and global change research community to interact with potential users of climate and global change science, as was demonstrated in the U.S. *National Assessment of the Potential Consequences of Climate Variability and Change* (NAST, 2001). The revised plan generally overlooks the insights and relationships that were developed by the National Assessment . . . (pp. 13–14).

On the significance of the regional-scale assessments included as part of the National Assessment, the NRC review said:

> The plan also does not include areas of research relevant to regional-scale assessments identified as a result of the National Assessment. . . . This deficiency needs to be remedied quickly so that the program's decision support activities reflect what the scientific community now knows, what it can accomplish, and what users would like to know (p. 14).

On the Administration's apparent refusal to provide any scientific rationale for the disappearance of any acknowledgement of the National Assessment, the NRC review said:

> For the most part the CCSP's revisions to the Strategic Plan are quite responsive to comments expressed at the workshop, in written input, and by this Committee. One notable exception is the fact that the revised plan does not acknowledge the substantive and procedural contributions of the U.S. *National Assessment of the Potential Consequences of Climate Variability and Change* (NAST, 2001), a major focus of the Global Change Research Program (GCRP) in the late 1990s. Many participants at the [CCSP] December [2002] workshop criticized how the draft Strategic Plan treated the National Assessment, as did this Committee in its first report. The revised plan does not reflect an attempt to address these concerns, and no rationale for this decision has been provided. (pp. 29–30).

Although OSTP Director John Marburger has referred to the National Academy of Sciences as the "gold standard" of scientific advice to the government, and despite the criticism of the plan for failing to provide any rationale for the disappearance of the National Assessment, Dr. Marburger, then-CCSP Director James R. Mahoney, and other Administration officials and CCSP leaders offered no response to this criticism of how they treated the National Assessment. No changes were made to the Strategic Plan in response to the NRC's criticism. It appeared to me that something akin to a conspiracy of silence was being enforced within the Federal Government, which had nothing to do with the scientific merits of the National Assessment.

The Role of the Council on Environmental Quality

The Administration, without ever clarifying the issue forthrightly, has allowed a perception to persist that the suppression of the National Assessment was required by a legal agreement pursuant to a joint stipulation to dismissal of a 2001 lawsuit filed by the Competitive Enterprise Institute *et al.,* seeking to halt the distribution

of the National Assessment. White House and Climate Change Science Program officials have never offered an honest public explanation of why the terms of that dismissal would have legally required (as distinct from an unofficial, secret political agreement) that the White House and the Federal agencies suppress a taxpayer-funded, scientifically based assessment sponsored by the Federal global change research program, even for purposes of using it as a scientific document or in program planning for research and future assessments.

I have examined the official court records on lawsuits filed by CEI *et al.,* in 2001 and 2003 and find no basis for such suppression. Rather, it appears that, although the CEI lawsuits were dismissed, the Administration decided nevertheless to award what I have termed the global warming denial machine a political victory that they could not have won had their lawsuits gone to trial. Myron Ebell of CEI has been quoted as saying of the National Assessment, "To the degree that it has vanished, we have succeeded" (*Greenwire,* October 3, 2006).

It is my understanding that the White House directed CCSP Director Mahoney to suppress the use of and references to the National Assessment in program planning and publications. It is my understanding that this directive was likely given by Philip Cooney at CEQ, acting as an agent of CEQ Chairman James Connaughton and, by extension, the White House policy and political apparatus. One of the CCSP agency principals informed me that a subsequent directive to the agencies to refrain from referencing the National Assessment had come from Mahoney's office. Mahoney later confirmed to *Environmental Science & Technology,* a journal of the American Chemical Society, that Federal researchers were restricted from referring to the National Assessment (*Environmental Science & Technology Online,* October 12, 2005).

Unlike the other representatives on the program's interagency principals committee, the great majority of whom were career science program management professionals, CCSP Director Mahoney was a Senate-confirmed Presidential appointee, as the Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy Administrator of the National Oceanic and Atmospheric Administration, and thus a political representative of the Administration. On the matter of not citing or using the National Assessment, I believe it was well-understood by the agency principals that to challenge the Chairman would, in effect, have been to challenge the White House—in particular CEQ.

Building appropriately on the pioneering work of the National Assessment could have had a salutary influence on developing the priorities of the CCSP Strategic Plan and surely would have led the program toward a different overall configuration of follow-up scientific and assessment priorities. It could have led to a different approach to evolving the discourse between scientists and users of information—a freer relationship and one less constrained than is the current process by political gatekeepers concerned with controlling the flow of communications about climate change and its implications for the United States.

2. The Administration Has Acted in a Variety of Ways To Impede and Manipulate Communication About Climate Change by Federal Scientists and Career Science Program Leaders to Wider Audiences, Including Congress and the Media

The ability of our society and public officials to make good decisions about important issues depends on a free, honest, and accurate flow of scientific research and findings. Unfortunately, the Administration and industry-funded special interest groups have acted to impede and manipulate essential communication about global climate change and its implications for society and the environment. The many climate scientists in the employ of the Federal Government represent a tremendous resource. Their knowledge and advice should be heeded, rather than manipulated or ignored. Without strong action to protect and restore integrity of Federal climate science communication, our Nation will be ill-prepared to deal with the challenge of global climate change.

Atmosphere of Pressure: The Union of Concerned Scientists—Government Accountability Project Joint Report

On January 30, 2007, the Union of Concerned Scientists and the Government Accountability Project[3] released their joint report, *Atmosphere of Pressure: Political In-*

[3] The Union of Concerned Scientists is the leading scinece-based nonprofit working for a healthy environment and a safer world. The UCS Scientific Integrity Program mobilizes scientists and citizens alike to defend science from political interference and restore scientific in-

Continued

terference in Federal Climate Science. The *Atmosphere of Pressure* study found that 150 Federal climate scientists report personally experiencing at least one incident of political interference in the past 5 years, for a total of *at least* 435 such incidents. I have transmitted the report to the Committee as a supplement to my written testimony.*

As a part of this study, UCS sent surveys to 1,600 climate scientists at seven Federal agencies and departments, to gauge the extent to which politics was playing a role in scientists' research. 279 scientists responded to the survey. At the same time, GAP conducted 40 in-depth interviews with Federal climate scientists and other officials and analyzed thousands of pages of government documents, obtained through the Freedom of Information Act (FOIA) and inside sources, regarding agency media policies and Congressional communications.

These two complementary investigations arrived at similar conclusions regarding the state of Federal climate research and the need for strong policies to protect the integrity of science and the free flow of scientific information. The following is taken from the Executive Summary of the UCS–GAP joint report:

Political Interference With Climate Science

The Federal Government needs accurate scientific information to craft effective policies. Political interference with the work of Federal scientists threatens the quality and integrity of these policies. As such, no scientist should ever encounter any of the various types of political interference described in our survey questions. Yet unacceptably large numbers of Federal climate scientists personally experienced instances of interference over the past 5 years:

- Nearly half of all respondents (46 percent of all respondents to the question) perceived or personally experienced pressure to eliminate the words "climate change," "global warming" or other similar terms from a variety of communications.
- Two in five (43 percent) perceived or personally experienced changes or edits during review that changed the meaning of scientific findings.
- More than one-third (37 percent) perceived or personally experienced statements by officials at their agencies that misrepresented scientists' findings.
- Nearly two in five (38 percent) perceived or personally experienced the disappearance or unusual delay of websites, reports, or other science-based materials relating to climate.
- Nearly half (46 percent) perceived or personally experienced new or unusual administrative requirements that impair climate-related work.
- One-quarter (25 percent) perceived or personally experienced situations in which scientists have actively objected to, resigned from, or removed themselves from a project because of pressure to change scientific findings.
- Asked to quantify the number of incidents of interference of all types, 150 scientists (58 percent) said they had *personally experienced* one or more such incidents within the past 5 years, for a total of *at least* 435 incidents of political interference.

The more frequently a climate scientist's work touches on sensitive or controversial issues, the more interference he or she reported. More than three-quarters (78 percent) of those survey respondents who self-reported that their research "always" or "frequently" touches on issues that could be considered sensitive or controversial also reported they had personally experienced at least one incident of inappropriate interference. More than one-quarter (27 percent) of this same group had experienced six or more such incidents in the past 5 years.

Barriers to Communication

Federal scientists have a constitutional right to speak about their scientific research, and the American public has a right to be informed of the findings of taxpayer-supported research. Restrictions on scientists who report findings contrary to an administration's preferred policies undermine these basic rights. These practices

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tegrity in Federal policymaking. More information about UCS and the Scientific Integrity Program is available online at *www.ucsusa.org/scientific_integrity.*

The Government Accountability Project (GAP) is the Nation's largest whistleblower organization. GAP attorneys and organizers assist whistleblowers in taking their evidence of wrongdoing to appropriate government agencies, committees, and officials to investigate, expose, and rectify the problems they have identified. More information about GAP is available online at *www.whistleblower.org.*

*The information referred to has been retained in Committee files.

also contribute to a general misunderstanding of the findings of climate science and degrade our government's ability to make effective policies on topics ranging from public health to agriculture to disaster preparation.

The investigation uncovered numerous examples of public affairs officers at Federal agencies taking a highly active role in regulating communications between agency scientists and the media—in effect serving as gatekeepers for scientific information.

Among the examples taken from interviews and FOIA documents:

- One agency scientist, whose research illustrates a possible connection between hurricanes and global warming, was repeatedly barred from speaking to the media. Press inquiries on the subject were routed to another scientist whose views more closely matched official Administration policy.
- Government scientists routinely encounter difficulty in obtaining approval for official press releases that highlight research into the causes and consequences of global warming.
- Scientists report that public affairs officers are sometimes present at or listen in on interviews between certain scientists and the media.
- Both scientists and journalists report that restrictive media policies and practices have had the effect of slowing down the process by which interview requests are approved. As a result, the number of contacts between government scientists and the news media has been greatly reduced.

Highly publicized incidents of interference have led at least one agency to implement reforms; in February 2006, NASA adopted a scientific openness policy that affirms the right of open scientific communication. Perhaps as a result, 61 percent of NASA survey respondents said recent policies affirming scientific openness at their agency have improved the environment for climate research. While imperfect, the new NASA media policy stands as a model for the type of action other Federal agencies should take in reforming their media policies.

The investigation also highlighted problems with the process by which scientific findings are communicated to policymakers in Congress. One example, taken from internal documents provided to GAP by agency staff, shows edits to official questions for the record by political appointees, which change the meaning of the scientific findings being presented.

Inadequate Funding

When adjusted for inflation, funding for Federal climate science research has declined since the mid-1990s. A majority of survey respondents disagreed that the government has done a good job funding climate science, and a large number of scientists warned that inadequate levels of funding are harming the capacity of researchers to make progress in understanding the causes and effects of climate change. Budget cuts that have forced the cancellation of crucial Earth observation satellite programs were of particular concern to respondents.

Poor Morale

Morale among Federal climate scientists is generally poor. The UCS survey results suggest a correlation between the deterioration in morale and the politicized environment surrounding Federal climate science in the present Administration. One primary danger of low morale and decreased funding is that Federal agencies may have more difficulty attracting and keeping the best scientists.

A large number of respondents reported decreasing job satisfaction and a worsening environment for climate science in Federal agencies:

- Two-thirds of respondents said that today's environment for Federal Government climate research is worse compared with 5 years ago (67 percent) and 10 years ago (64 percent). Among scientists at NASA, these numbers were higher (79 percent and 77 percent, respectively).

A Case Study of Political Interference From My Experience

I worked on many projects during the 10 years I served in the program office. One key ongoing project for which I was responsible involved coordinating the development of and editing nine editions of the program's annual report to Congress, *Our Changing Planet.* The report is distributed to all Members of Congress and all Congressional committees and subcommittees with relevant oversight or budget jurisdiction. The report also is distributed more widely and is one of the principal means by which information about the highlights of recent research and research plans of the Federal program as a government-wide entity is communicated. I also provided senior advisory and editorial support on a number of aspects of the development of

the *Strategic Plan for the U.S. Climate Change Science Program,* issued in July 2003 and distributed to Congress and more widely in both print and electronic form.

In developing program publications and on other matters, I worked with a large network of career science program managers in the participating agencies. In producing a particular edition of the *Our Changing Planet* report, I would work with as many as 90 individual contributors, spanning as many as 13 participating agencies, to solicit, coordinate, and edit their submissions and review comments into a completed, integrated document. Before being issued, this report had to be reviewed and approved, first by career science program managers in all participating agencies, then by Administration officials in the Executive Office of the President (EOP), including OSTP, OMB, and CEQ.

Starting in October 2002, in this final-stage editorial review and clearance process, it came to my attention that CEQ Chief of Staff Philip Cooney was extensively marking up reports in a manner that had the cumulative effect of adding an enhanced sense of scientific uncertainty about global warming and minimizing its likely consequences, while also deleting even minor references to the National Assessment.

For example, in a memorandum dated October 28, 2002, he marked-up the first draft of the CCSP Strategic Plan after it was approved by CCSP agency principals and before it was released for NRC review and public comment. Most of his roughly 200 text changes were incorporated in the review draft. A number of these changes in text relating to questions of climate science altered the content of the draft as it had been developed by Federal science program professionals. Taken in the aggregate, the changes had a cumulative effect of shifting the tone and content of an already quite cautiously-worded draft to create an enhanced sense of scientific uncertainty about climate change and its implications. The draft Strategic Plan was legitimately criticized by reviewers who charged that the CCSP had adopted a vocabulary with an exaggerated emphasis on scientific uncertainties. To my knowledge this CEQ mark-up was not shared with or vetted by CCSP principals or CCSP agency science program managers. The process was quintessentially non-transparent and, in my view, a policy-driven political interference in a key science program document.

As another example, the CEQ Chief of Staff made about 100 revisions to the final draft of the FY 2003 *Our Changing Planet,* some of which substantially changed or deleted text relating, for example, to decision support on mitigation and adaptation options, integration of climate science with comparative analysis of response strategies, ongoing regional assessments of global change consequences, and the relationship between energy-related emissions, climate change, and ecosystem impacts.

I could give additional examples, but I will conclude with a few summary observations about this process:

(a) From my observation, a few examples of relatively heavy-handed interventions sufficed to send a message to the program leadership about White House political sensitivities. Under those circumstances, I believe a kind of anticipatory self-censorship kicks in, and reports begin to be drafted with an eye to what will be able to obtain CEQ approval—which appeared to be the final step in the White House clearance process.

(b) Although this matter has received a good deal of media and political attention, I have always regarded it as essentially a single graphic case study illustration of a much larger pattern of Administration interference with and spinning of climate change science communication. I believe it is an indicative and revealing case study, but I believe we should focus primarily on the larger pattern and take steps to correct a whole set of problems. The former CEQ Chief of Staff has moved on to a position with ExxonMobil, but rearranging the deck chairs does not make the problems go away and, as part of his legacy, the National Assessment he played a role in suppressing remains suppressed.

(c) It has been suggested by some critics that, since neither I nor Cooney is a scientist, this issue is simply a matter of competing editorial viewpoints. I believe this view betrays a fundamental misunderstanding of the problem, calling for some clarification. My job was to work closely with career science professionals to communicate climate research information clearly and accurately in such a way that it would be readily understandable and of value to general attentive readers such as those in Congressional offices. There was no political agenda other than to encourage a bipartisan appreciation for the value of this national research program. The science professionals I worked with will attest to the appropriateness of my role, the integrity with which I played it, and my grasp of the subject matter, as will the fact that I was asked to continue in this role throughout my tenure with the program. I was aligned with and accountable to the mainstream climate science community every step of the way. CEQ

was not. What CEQ was doing with its interventions was something quite different, and in my view of clearly questionable legitimacy. I see that as the essential difference in our roles.

3. The Administration Has Cut the Climate Change Research Budget to its Lowest Level Since 1992 and Is Presiding Over What Appears To Be a Growing Crisis in the Global Climate Observing System, Thus Undermining a Critical National Intelligence-Gathering Process

Funding for climate and global change research under the Global Change Research Program (FY 1989–FY 2002) and Climate Change Science Program (FY 2003–present) is shown in the table on the following page, which is taken from the CCSP website. The table shows that, in real terms, funding is currently at the lowest level since 1992.

The President's FY 2007 budget request for the CCSP was 26 percent less than the program's budget in 1995, the high-water mark. The FY 2007 request was 13 percent less than the program's budget in FY 2001, the last budget before the current Administration took office.

The Administration's response to criticism on climate change is often to point to how much is spent on research. The Climate Change Science Program is indeed a large program, with a budget that supports a wide range of both governmental and nongovernmental scientific research, as well as climate observing systems, in particular NASA's space-based remote-sensing observing system. But, notwithstanding the importance that Administration officials purport to give to the issues addressed by the program, the Administration is now steadily reducing the budget request for the program. Why?

A review of the CCSP budget tables as presented in the FY 2006 and FY 2007 editions of Our Changing Planet indicates generally that the steady cuts in the overall CCSP budget from FY 2004 onward are almost entirely attributable to cuts in the NASA Earth Science research and observations budget. The NASA budget figures as arrayed in *Our Changing Planet* during the past several years are difficult to interpret in any detail, nor is the discussion in the report of NASA's program at all illuminating about the reasons for and implications of the cutbacks in NASA's program, nor about how these cutbacks are allocated across specific clearly identifiable program activities. However, the report says that, *from FY 2005 to the FY 2007 request, NASA's CCSP budget was cut by 17 percent,* from $1.241 billion to $1.029 billion. (The inflation-adjusted cut would be greater.) *This includes a 13 percent cut in the "Scientific Research" portion of the budget, and a 20 percent cut in "Space-Based Observations."*

Funding for Global Change Research under the CCSP and USGCRP, Fiscal Years 1989–2007 (dollars in millions) *

Past, present and future budget data are key components of the information transmitted to Congress in ***Our Changing Planet.*** This table shows the evolution of funding for the program since 1989. Note that the scope of activities included within the budget is not constant over the period. In some cases (as in 1989–1990), a substantial portion of the year-to-year budget change results from shifting activities into or out of the program. These changes in program definition are the result of changing scientific priorities and other factors.

Fiscal Year	Actual dollars	Constant (2005) dollars
1989	134	209
1990	659	975
1991	954	1,355
1992	1,110	1,531
1993	1,326	1,775
1994	1,444	1,885
1995	1,760	2,234
1996	1,654	2,039
1997	1,656	1,995
1998	1,677	1,989
1999	1,657	1,925
2000	1,687	1,896
2001	1,728	1,886
2002	1,667	1,792
2003	1,766	1,857
2004	1,977	2,023

Funding for Global Change Research under the CCSP and USGCRP, Fiscal Years 1989–2007 (dollars in millions)*—Continued

Past, present and future budget data are key components of the information transmitted to Congress in ***Our Changing Planet.*** This table shows the evolution of funding for the program since 1989. Note that the scope of activities included within the budget is not constant over the period. In some cases (as in 1989–1990), a substantial portion of the year-to-year budget change results from shifting activities into or out of the program. These changes in program definition are the result of changing scientific priorities and other factors.

Fiscal Year	Actual dollars	Constant (2005) dollars
2005	1,865	1,865
2006 (estimate)	1,709	1,674
2007 (request)	1,715	1,643

*The table is posted on the Climate Change Science Program website at: *http://www.climatescience.gov/infosheets/highlight2/default.htm#funding.* The table was updated November 2006.

Without going into further detail in this written testimony, I suggest that this extraordinary scaling back of the Administration's commitment to a strong Earth Science research and observations program at NASA has very serious implications for the strength of the Nation's climate change science capability. The Administration must be held accountable for this indirect method of undermining the ability to understand, assess, and communicate what is happening with climate and associated global change—especially if we also take into consideration the extraordinary and disturbing developments with the NPOESS next-generation weather-climate satellite system that are taking place on the watch of Administration officials at DOD, NOAA, and NASA.

The NPOESS Crisis

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) was created by a Presidential Decision Directive in 1994, under which the military and civil meteorological programs were merged into a single program. NPOESS was intended as an operational system to provide state-of-the art data for weather forecasting and climate system monitoring. Within NPOESS, NOAA is responsible for satellite operations, the Department of Defense (DOD) is responsible for major acquisitions, and NASA is responsible for the development and infusion of new technologies.

To continue climate-quality measurements beyond the first series of NASA's Earth Observing System (EOS) research satellites (NASA is not developing a second series of EOS satellites), it was assumed that the NPOESS system would continue, in an operational environment, the mature EOS measurements, many of which address the Nation's climate monitoring needs.

NPOESS, as originally configured, would have represented a significant step forward in the Nation's ability to deploy a comprehensive climate observing system. Many key climate variables would be measured for decades. However, cost estimates for the program skyrocketed from $6.5 billion to $10 billion and the scheduled launch of its first satellite slipped from May 2006 to at least April 2008—a gap that the Government Accountability Office concluded could leave the United States with gaps in vital climate and weather forecasting data.

As a result of the massive cost overrun, NPOESS was subjected to a statutorily required re-scoping in 2006. During the re-scoping process, ground rules endorsed by the NPOESS Executive Committee stipulated that a higher priority would be placed on the continuity of operational capabilities in support of weather measurements, which resulted in a lower priority for climate-focused measurements. The Office of the Secretary of Defense (OSD) led a tri-agency process culminating in the certification of a restructured NPOESS Program on June 5, 2006. The result was a decision to reduce the overall number of satellites and eliminate climate sensors from the system.

Climate Science Watch has obtained a December 11, 2006, joint document prepared by the NASA Earth Science Division and the NOAA Climate Observations and Analysis Program that describes the impacts of the Nunn-McCurdy Certification of NPOESS on the climate program goals of NASA and NOAA. The document was developed at the direction of the Office of Science and Technology Policy (OSTP) as a result of a meeting on June 26, 2006.

On the importance of a continuous climate-quality data record, the report says:

> Detecting climate change, understanding the associated shifts in specific climate processes, and then projecting the impacts of these changes on the Earth system requires a comprehensive set of consistent measurements made over many decades. Many climate trends are small and require careful analysis of long time series of sufficient length, consistency, and continuity to distinguish between the natural long-term climate variability and any small, persistent climate changes. *Interruptions in the climate data records make the resolution of small differences uncertain or even impossible to detect.* To confidently detect small climate shifts requires instrument accuracy and stability better than is generally required for weather research and most other scientific uses. For more than thirty years, NASA research-driven missions, such as the EOS, have pioneered remote sensing observations of the Earth's climate, including parameters such as solar irradiance, the Earth's radiation budget, ozone vertical profiles, and sea surface height. Maintaining these measurements in an operational environment provides the best opportunity for maintaining the long-term, consistent, and continuous data records needed to understand, monitor, and predict climate variability and change.

On the implications of losing the NPOESS climate sensors, the report concludes:

> For NASA, NPOESS was not only a converged civilian and military weather observing system but also *the cornerstone of the Nation's future climate research program.* For NOAA, NPOESS represented *a key component of the operational climate observing program* and a cornerstone of its Climate Goal. . . .
>
> Unfortunately, the recent loss of climate sensors due to the NPOESS Nunn-McCurdy Certification *places the overall climate program in serious jeopardy.*
>
> These shortfalls are characterized in a letter from the Chair of the Joint Science Committee from the World Climate Research Programme (WCRP) and from the Chair of the Steering Committee from the Global Climate Observing System (GCOS) to the Chair of the Committee on Earth Observation Satellites (CEOS). The Chairs from WCRP and GCOS stated:
>
>> Some of the difficulties in establishing and maintaining climate observations from space are currently being highlighted by the de-scoping of NPOESS, in which climate observations have been seriously compromised. . . . *[U]nless revised plans compensate for the anticipated shortcomings in climate observations, gaps in several key climate data records (some that go back almost 30 years) are highly likely. . . . WCRP and GCOS assert that our ability to address critical climate issues, with profound societal implications, will be strongly limited unless observation of climate variables is given higher priority. We urge that this be done.* [emphasis added]

The report contains joint NASA–NOAA recommendations as to how the impacted climate-related observations and related science might be recovered. However, there is no indication as to the projected cost of even a partial recovery of the observing capability to be lost under the current re-scoping of NPOESS. Nor is there any indication of whether the Administration will request the funding needed in order to implement a recovery.

Who is accountable for the mismanagement and failure of leadership of this essential program? A May 2006 investigative report by the Commerce Department Inspector General was sharply critical of high-level Federal management for failing to deal effectively with the long delays and major cost overruns in the development and deployment of NPOESS.[4]

Conclusions and Recommendations

1. Revitalize the National Assessment Process

Reports of a steady stream of scientific findings on global climate change, in particular reports on observed and projected consequences of global warming, have increased the level of concern among policymakers and the public. Debate on appropriate climate change policy and response strategies at the international, national, and state levels has also increased in urgency in the U.S. public arena. In this context, re-activating the National Assessment process and producing a second National Assessment report would make a major contribution to the Nation's preparedness for addressing the challenge of global warming and climate change.

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[4] U.S. Department of Commerce, Office of Inspector General, National Oceanic and Atmospheric Administration—*Poor Management Oversight and Ineffective Incentives Leave NPOESS Program Well Over Budget and Behind Schedule.* Audit Report No. OIG–17794–6–0001/May 2006.

The essential idea is not to replicate the 2000 National Assessment in its particulars, but rather to move forward with a strong, updated, coordinated, integrative effort, employing the method of having climate scientists and other experts communicate directly with policymakers and other stakeholders, geographical region-by-region, and socioeconomic sector-by-sector, to diagnose vulnerabilities and develop response strategies, without political interference with free and open communication. Climate change impacts vary by region and sector, as do response strategy options. Every Member has an interest in the kind of information such an assessment could make available for consideration in developing national policy.

2. Address the Problems of the Council on Environmental Quality, Agency Media Policies, and Public Communication by the Climate Change Science Program

On the White House Council on Environmental Quality

The UCS–GAP report does not substantially address the higher levels in the chain of command that has resulted in political interference with climate science communication, starting with the President. In particular, the report does not focus on the role of the Council on Environmental Quality. CEQ is a White House policy office, not a science office. In my view it was problematic from day one that CEQ officials, whose essential job was to advance the President's policy and political position on global climate change, were at the table participating directly in the governance of the Climate Change Science Program and shaping its communication of climate change research. In my judgment, CEQ should be put back on the policy side of the science-policy fence—as was the case under the previous Administration. And management of the CCSP should be back on the science side of the fence.

On Agency Media Policies

The Government Accountability Project has prepared a critical analysis of the new media policy developed at NASA in 2006 in the wake of publicity surrounding NASA's scandalous attempt to muzzle public communication by Dr. James Hansen, Director of the NASA Goddard Institute of Space Studies. While the NASA media policy appears to be an improvement over the prior situation, GAP's analysis raises concerns about agency media policies and identifies legislative action that the Committee should consider. A statement and memorandum prepared by Tom Devine, Legal Director at GAP, is included with this testimony as an Appendix.

On Public Communication by the Climate Change Science Program

Congressional oversight should include a focus on the Climate Change Science Program and the CCSP Office as well as the agencies. In order to ensure the scientific independence and credibility of the program and its products, the CCSP should develop CCSP-wide principles and policies on communications to ensure the scientific independence of climate change science communications.

Currently, there is no procedure under which the CCSP, or the CCSP Office, can communicate on behalf of the Federal climate research enterprise as a whole. Media inquiries to the CCSP are channeled to the NOAA Public Affairs Office—an office that, as discussed in the UCS–GAP report, has been politically compromised in its climate science communication by the Department of Commerce and by the Administration political appointees at the head of NOAA. One key example has been communication on the scientific question of the relationship between global warming and increased hurricane intensity.

Congress, the media, and the public need to be able to receive communications directly from the Climate Change Science Program that are not filtered through the public and governmental affairs offices of a single agency. One alternative would be to give the Climate Change Science Program Office the resources, staffing with scientific expertise, and freedom from White House political manipulation, to communicate, and to coordinate communications, on behalf of the full range of scientific research supported by the CCSP participating agencies.

3. Implement the Recommendations of the Union of Concerned Scientists—Government Accountability Project Report

The UCS–GAP report, *Atmosphere of Pressure—Political Interference in Federal Climate Science* has brought to light numerous ways in which U.S. Federal climate science has been filtered, suppressed, and manipulated in the last 5 years. I fully support the UCS and GAP recommendations of the following reforms and actions:

- Congress must act to specifically protect the rights of Federal scientists to conduct their work and communicate their findings without interference and protect scientists who speak out when they see interference or suppression of science.

- The Federal Government must respect the constitutional right of scientists to speak about any subject, including policy-related matters and those outside their area of expertise, so long as the scientists make it clear that they do so in their private capacity. Scientists should also be made aware of these rights and ensure they are exercised at their agencies.
- Ultimate decisions about the communication of Federal scientific information should lie with scientists themselves. While non-scientists may be helpful with various aspects of writing and communication, scientists must have a "right of last review" on agency communications related to their scientific research to ensure scientific accuracy has been maintained.
- Pre-approval and monitoring of media interviews with Federal scientists by public affairs officials should be eliminated. Scientists should not be subject to restrictions on media contacts beyond a policy of informing public affairs officials in advance of an interview and summarizing the interaction for them afterwards.
- Federal agencies should clearly support the free exchange of scientific information in all venues. They should investigate and correct inappropriate policies, practices, and incidents that threaten scientific integrity, determine how and why problems have occurred, and make the necessary reforms to prevent further incidents.
- Congress should immediately exert pressure on the Executive Branch to comply with its statutory duty under Federal law and undertake periodic scientific assessments of climate change that address the consequences for the United States. (The last national assessment was conducted in 2000.)
- Funding decisions regarding climate change programs should be guided by scientific criteria, and must take into account the importance of long-term, continual climate observation programs and models.
- All branches of the government must have independent scientific advice.

3. End the Cutbacks and Restore Support for Space-Based Observations and Long-Term Monitoring of Essential Climate and Global Change Variables

The scaling back of the Administration's commitment to a strong Earth Science research and observations program at NASA should be the subject of in-depth Congressional oversight. The Committee should investigate the implications of these cutbacks for the Nation's climate change research capability and should seek to rectify this situation with appropriate funding levels and program oversight.

Congress should also hold Administration officials accountable for allowing essential climate sensors to be dropped from NPOESS, the next-generation DOD–NOAA environmental satellite system, at the same time NASA is not developing a next generation of its Earth Observing System satellites. The Committee's oversight should include investigation of recommendations for mitigation of the crisis that have been developed under the guidance of the NASA Earth Science Division and the NOAA Climate Observations and Analysis Program.

In each case, I recommend that the Committee not limit itself to hearing testimony from Administration political appointees, such as the NASA Administrator, the NOAA Administrator, or the Director of the Office of Science and Technology Policy. Officials whose primary commitment is to advance White House policy and political objectives will tend to put the best face on a bad situation and be less than fully forthcoming with the Committee with explanations of the real problems. Instead, I recommend that the Committee hear from and ask the tough questions of senior career officials with both programmatic and technical expertise, such as Jack Kaye of the NASA Earth Science Division and Thomas Karl of the NOAA National Climatic Data Center. Hopefully they will feel free to tell you a straight story.

APPENDIX

NASA and other agencies have trumpeted new media policies as proof of their good intentions and new-found respect both for scientific freedom and freedom of speech. Indeed, the policies have appealing rhetoric that can help change bureaucratic attitudes. That matters. Depending on the political cycle, the rhetoric could be sufficient to sustain an open environment within scientific agencies.

Unfortunately, the policies' fine print exposes them as a trap that could be used to fire, or potentially prosecute, almost any scientist if the political environment becomes hostile again. First let's consider what's in them. The Achilles' heel is a loophole that cancels all the new free speech rights if a scientist discloses information in new, pseudo-classified, hybrid secrecy categories. These categories, with new names such as "Sensitive but Unclassified" or "Sensitive Security Information," do

not purport to have the national security significance of classified documents. In fact, they are just new names for longstanding categories like "For Official Use Only," that primarily are secrecy shields of convenience for virtually any information the agency wants to keep off the market of public discourse, either to control timing or avoid embarrassment. Although the SBU or SSI brands can be issued arbitrarily, the potential criminal liability can be even more severe than for genuinely classified information.

Even worse, information can be designated as SBU or SSI after-the-fact. For example, one GAP air marshal client has been fired 3 years after-the-fact for disclosing Sensitive Security Information, even though it was not marked as restricted at the time. The whistleblower was challenging a security breakdown, and his dissent was vindicated as the agency quickly canceled a reckless decision when it became public. Depending on the next election results or other factors that should be irrelevant, under NASA's fraudulent media policy reform, every NASA scientist communicating with this Committee could be fired several years from now for disclosing Sensitive but Unclassified information.

Not only is the policy disingenuous, it is illegal. It violates the Whistleblower Protection Act on its face, because that law only permits blanket restrictions on public speech if information is properly classified.

Let's also consider what the policy doesn't include. The Anti-Gag Statute, an appropriations rider passed unanimously by Congress for the last 18 years, bans any spending to implement or enforce any nondisclosure policy, form or agreement, unless it also has an addendum with specific Congressional language that, in the event of a conflict with the policy, the Whistleblower Protection Act and the Lloyd-Lafollette Act protecting safe communications with Congress will supersede any contradictory language and prevail. The NASA media policy does not contain this addendum. Any funds spent to implement and enforce it have been and will be illegal expenditures.

There is no possibility that this was a good faith error. GAP's legal director Tom Devine spent over an hour tutoring the NASA Office of General Counsel lawyer who wrote the phony reform, both on the requirements of the Whistleblower Protection Act and the Anti-Gag Statute. The lawyer reassured GAP that he understood what those laws required. But NASA issued a policy that is a custom fit for violating these fundamental merit system and whistleblower rights for scientific freedom. The illegality is deliberate.

Legislation co-sponsored in the last Congress by Representatives Waxman, Davis, and Platts and marked up unanimously in committee (H.R. 1317 and H.R. 5112) directly addresses this type of back-door scientific repression. It codifies and provides a remedy for the Anti-Gag Statute, and establishes checks and balances on the currently-unrestrained use of pseudo-classification gag orders. The media policy's fine print illustrates why your Committee should act immediately to pass this badly needed reform. The Committee also should have GAO audit how much money has been spent illegally to implement and enforce the NASA media policy. An April 1, 2006, memorandum GAP prepared on the policy is attached.

MEMORANDUM

To: Climate Scientists
From: Government Accountability Project
Re: Analysis of NASA's Recently Released Media Policy

The Government Accountability Project (GAP) is issuing advisory comments on NASA's new media policy that it released yesterday, March 30. The new policy came in response to public outcry over NASA's suppression of climate science research inconsistent with the Bush Administration's political agenda. NASA is touting the development as a free-speech breakthrough for agency scientists.

GAP identified the areas *in which the new policy is an improvement:*

- NASA Administrator Michael Griffin's reassuring rhetoric is of symbolic value, demonstrating official respect for scientific freedom.
- The new media policy does not cover scientific reports, web postings, or professional dialogue such as at conferences, allowing scientists to share information with their colleagues without going through public affairs political appointees.
- The policy officially recognizes the free speech right for scientists to express their "personal views" when they make clear that their statements are not being made on behalf of NASA.

However, *in six critical areas the new policy falls short* of genuine scientific freedom and accountability, and potentially undermines the positive guarantees:

- While recognizing the existence of a "personal views" exception, the policy doesn't announce the circumstances when that right cancels out conflicting restrictions, which are phrased in absolute terms applying to contexts such as "any activities" with significant media potential. This leaves a cloud of uncertainty that translates into a chilling effect for scientists.
- The policy fails to comply with the legally-mandated requirements of the Anti-Gag Statute to explicitly include notice that the Whistleblower Protection Act and Lloyd-Lafollette Act (for Congressional communications) limit and supersede its restrictions.
- The policy institutionalizes prior restraint censorship through "review and clearance by appropriate officials" for "all NASA employees" involved in "preparing and issuing" public information. This means that scientists can be censored and will need advance permission from the "appropriate" official before anything can be released.
- The policy defies the WPA by requiring prior approval for all whistleblower disclosures that are "Sensitive But Unclassified" (SBU). The legal definition of SBU is broad and vague, to the point that it can be interpreted to sweep in virtually anything. The WPA only permits that restriction for classified documents or those whose public release is specifically banned by statute.
- The policy bans employees' free speech and WPA rights to make anonymous disclosures, requiring them to work with NASA public affairs "prior to releasing information" or "engaging in any activities or events that have the potential to generate significant media or public interest or inquiry."
- The policy gives NASA the power to control the timing of all disclosures, which means scientists can be gagged until the information is dated and the need for the public to know about critical scientific findings has passed.

In December of last year, NASA climatologist Dr. James Hansen was threatened with "dire consequences" by a political appointee for statements he made about the consequences of climate change. According to GAP's legal director, Tom Devine, "Under this so-called reform, Dr. Hansen would still be in danger of 'dire consequences' for sharing his research, although that threat is what sparked the new policy in the first place. The new policy violates the Whistleblower Protection Act, the Anti-Gag Statute, and the law protecting communications with Congress, the Lloyd-Lafollette Act. The loopholes are not innocent mistakes or oversights. GAP extensively briefed the agency lawyer on these requirements, who insisted he understood them fully. NASA is intentionally defying the good government anti-secrecy laws."

The CHAIRMAN. Thank you very much, Mr. Piltz. I'd like to assure the panel that all of your prepared statements and reports will be made part of the Committee's record. And I can assure you that we will study them very carefully.

And now, may I call upon the Bren Research Professor, Chemistry and Earth System Science, School of Physical Sciences, University of California, Dr. F. Sherwood Rowland.

STATEMENT OF DR. F. SHERWOOD ROWLAND, PROFESSOR, CHEMISTRY AND EARTH SYSTEM SCIENCE, SCHOOL OF PHYSICAL SCIENCES, UNIVERSITY OF CALIFORNIA, IRVINE

Dr. ROWLAND. Thank you, Mr. Chairman.

I'm Sherwood Rowland, Professor of Chemistry and Earth System Science at the University of California, Irvine, where I have been for more than 40 years.

I first testified to the U.S. Congress in December 1974, in connection with the study published that year with Professor Mario Molina on the depletion of stratospheric ozone by the chlorofluorocarbon gases, then used worldwide as refrigerants and aerosol propellants.

The following year, the same gases were identified as being potent greenhouse gases, despite their very low concentrations in

Earth's atmosphere. Three years later, members of our research laboratory at the University of California Irvine, began collecting ground-level atmospheric samples in widely distributed remote locations in both Northern and Southern hemispheres, to monitor these rising, global CFC concentrations.

When we extended our studies beyond the CFCs, we quickly discovered that the concentrations of methane gas found in these samples after emission from rice paddies, swamps, coal mines, cows and other sources, were also increasing. Because of the greenhouse gas significance of both CFCs and methane, we have continued now for 28 years, with financial support from NASA, to monitor these gases in atmospheric samples collected quarterly from Northern Alaska, to Southern New Zealand.

The concentration of methane gas in the atmosphere has more than doubled since 1800, as shown by comparison with the concentrations found in air bubbles in glacial ice cores. This growth has made methane a significant contributor to global greenhouse forcing over these two centuries, second only to gaseous carbon dioxide, in quantitative importance up to the present.

In our continuing analyses of atmospheric composition, we now have a record, more than a decade long, in both hemispheres, of the concentrations of more than 100 gaseous molecules, of either natural or industrial origin. In addition, with the support of the Department of Energy we have applied the identical analytical techniques to the same set of atmospheric gases in more than 20 U.S., and many foreign cities, and to the U.S. Southwest as a region.

These data are very pertinent to estimates of the contributions of tropospheric ozone, another greenhouse gas. All of these studies form a small part of the much larger scientific understanding of the greenhouse effect, global warming, and the accompanying concern about abrupt climate change. This background of participation in the atmospheric science community has meant interactions both within the science itself, and in its interfaces with the various governmental organizations, and the general public.

Beginning in 1988, the global scientific understanding of these areas began to be organized internationally by the Intergovernmental Panel on Climate Change, or IPCC. The initial portion of the fourth IPCC report on the fundamental science of the planetary energy balances, and how they effect the climate, was reported in Paris last week. It was, and is, a very stark presentation of how the growing concentrations of the greenhouse gases and other ongoing atmospheric changes are already significantly affecting large portions of the Earth, for example, melting of ice in the polar North, and prolonged, severe drought in Southeastern Australia.

The outlook for the coming decades is for much further change, including rising sea level, hurricane intensity, *et cetera*.

This IPCC report represents an outstanding effort on the part of the international scientific community, and has the support of almost all of its members. Complete unanimity is never expected, nor is there any mechanism for establishing the competence and credibility of those claiming to speak as scientists, other than the seldom-performed examination of his or her record of past successes and failures.

The closer we come to widespread public interest from the general public, the harder it becomes to evaluate the merits of the scientific case in the mix of other opinions. The IPCC report represents the best effort of the scientific community to evaluate the problems of climate change, and it should be listened to by us.

Those of us who are based in universities are accustomed to presenting, directly, our findings and our opinions about the context of our results. And in most of my experience, our colleagues in national laboratories have had almost as much freedom in their presentations.

Describing one's work as one sees it is the bedrock of the scientific enterprise. However, in the last several years, my scientific conversations have run into far too many instances in which the reports of the significance of the work have been subsequently changed by others—often by persons with less, or even no, expertise in the subject at hand.

Some of these conflicts have been gathered together with verified details by the Union of Concerned Scientists, and by the Government Accountability Project, and are presented here today. Working out the best approaches to mitigation or adaptation to future climatic change, is critically dependent upon possession of the most accurate and pertinent knowledge.

I will conclude by quoting the remarks of the late Senator John Chafee, of Rhode Island, at the closing of a hearing on the atmosphere which had just been held with the Senate Subcommittee on the Environment, which he chaired. "If we were masters of the world, we would do something about carbon dioxide. But we are not. We can't tell the Soviets what to do, or the Chinese. But, it seems to me, that is not an excuse for no action at all on the part of the United States. That is why I find fault with the view that, if we take action, the Europeans may not. But, that's not a call to inaction, to me. We ought to do what we can, and set an example."

These were his comments to us in June 1986, and unfortunately, they are just as applicable now as they were 21 years ago.

Thank you.

[The prepared statement of Dr. Rowland follows:]

PREPARED STATEMENT OF DR. F. SHERWOOD ROWLAND, PROFESSOR, CHEMISTRY AND EARTH SYSTEM SCIENCE, SCHOOL OF PHYSICAL SCIENCES, UNIVERSITY OF CALIFORNIA, IRVINE

I am Sherwood Rowland, Professor of Chemistry and Earth System Science at the University of California Irvine, where I have been for more than forty years. I first testified to the U.S. Congress in December 1974 in connection with the study published that year with colleague Prof. Mario Molina, on the depletion of stratospheric ozone by the chlorofluorocarbon gases then used worldwide as refrigerants and aerosol propellants. The following year, these same gases were identified as being potent greenhouse gases despite their very low concentrations in Earth's atmosphere. Three years later members of our research laboratory at the University of California Irvine—as did others—began collecting ground-level atmospheric samples in widely distributed remote locations in both northern and southern hemispheres to monitor these rising global CFC concentrations.

When we extended our studies beyond the CFCs, we quickly discovered that the concentrations of methane gas, found in these samples after emission from rice paddies, swamps, coal mines, cows and other sources, were also increasing. Because of the greenhouse gas significance of both CFCs and methane, we have continued, with financial support from NASA, to monitor these gases in atmospheric samples collected quarterly from northern Alaska to southern New Zealand. The concentration of methane gas in the atmosphere has more than doubled since 1800, as shown

by comparison with the concentrations found in air bubbles in glacial ice cores. This growth has made methane a significant contributor to added global greenhouse forcing over those two centuries, second only to gaseous carbon dioxide in quantitative importance up to the present.

In our continuing analyses of atmospheric composition, we now have a record more than a decade long in both hemispheres of the concentrations of more than one hundred gaseous molecules, of either natural or industrial origin. In addition, with the support of the Department of Energy, we have applied the identical analytical techniques to the same set of atmospheric gases in more than 20 U.S. and many foreign cities, and to the U.S. Southwest as a region. These data are very pertinent to estimates of the contributions of tropospheric ozone, another greenhouse gas. All of these studies form a small part of the much larger scientific understanding of the greenhouse effect, global warming, and the accompanying concern about abrupt climate change.

This background of participation in the atmospheric science community, has meant interactions both within the science itself and in its interfaces with the various governmental organizations and the general public. Beginning in 1988, the global scientific understanding of these areas began to be organized internationally by the Intergovernmental Panel on Climate Change, or IPCC. The initial portion of the Fourth IPCC report, on the fundamental science of the planetary energy balances and how they affect the climate, was reported in Paris last week. It was—and is—a very stark presentation of how the growing concentrations of the greenhouse gases and other ongoing atmospheric changes are already significantly affecting large portions of the Earth—for example, melting of ice in the polar North, and prolonged severe drought in southeastern Australia. The outlook for the coming decades is for much further change, including rising sea level, hurricane intensity, *etc*.

This IPCC report represents an outstanding effort on the part of the international scientific community, and has the support of almost all of its members. Complete unanimity is never expected, nor is there any mechanism for establishing the competence and credibility of those claiming to speak as scientists, other than the seldom performed examination of his or her record of past successes and failures. The closer we come to widespread public interest from the general public, the harder it becomes to evaluate the merits of the scientific case in the mix of other opinion. The IPCC report represents the best effort of the scientific community to evaluate the problems of climate change, and it should be listened to.

Those of us who are based in universities are accustomed to presenting directly our findings and our opinions about the context of our results. In most of my experience, our colleagues in national laboratories have had almost as much freedom in their presentations. Presentation of one's work as one sees it is the bedrock of the scientific enterprise. However, in the last several years, my scientific conversations have run into far too many instances in which the reports of the significance of the work have been subsequently changed by others, often by persons with less, or even no, expertise in the subject at hand. Some of these conflicts have been gathered together, with verified details, by the Union of Concerned Scientists and by the Government Accountability Project, and are presented here today. The working out of the best approaches to mitigation or adaptation to future climatic change is critically dependent upon possession of the most accurate and pertinent knowledge.

I will conclude by quoting the remarks of the late Senator John Chafee of Rhode Island at the closing of a hearing on the atmosphere which had just been held with the Senate Subcommittee on the Environment, which he chaired.

> "If we were masters of the world, we would do something about carbon dioxide. But we are not. We can't tell the Soviets what to do, or the Chinese. But it seems to me that is not an excuse for no action at all on the part of the United States. That is why I find fault with the view that if we take action, the Europeans may not. But that is not a call to inaction to me. We ought to do what we can and set an example."

These were his comments in June 1986, and unfortunately they are just as applicable now as they were 21 years ago.

The CHAIRMAN. Dr. Rowland, I thank you very much, and if I may, I'd like to begin my questioning.

It has come to my attention that in July of last year, the American Enterprise Institute—a well-known think-tank in Washington—sent letters to climate scientists offering $10,000 to those willing to dispute the findings of the Intergovernmental Panel on

Climate Change, or IPCC, which consolidated world research on climate change, and concluded that human activities are warming the planet.

And, if I may, I'd like to place a copy of this letter in the record.

[The information previously referred to follows:]

AMERICAN ENTERPRISE INSTITUTE FOR PUBLIC POLICY RESEARCH
Washington, DC, July 5, 2006

Prof. STEVE SCHROEDER,
Department of Atmospheric Sciences,
Texas A&M University,
College Station, TX.

Dear Prof. Schroeder:

The American Enterprise Institute is launching a major project to produce a review and policy critique of the forthcoming Fourth Assessment Report (FAR) of the Intergovernmental Panel on Climate Change (IPCC), due for release in the Spring of 2007. We are looking to commission a series of review essays from a broad panel of experts to be published concurrent with the release of the FAR, and we want to invite you to be one of the authors.

The purpose of this project is to highlight the strengths and weaknesses of the IPCC process, especially as it bears on potential policy responses to climate change. As with any large-scale "consensus" process, the IPCC is susceptible to self-selection bias in its personnel, resistant to reasonable criticism and dissent, and prone to summary conclusions that are poorly supported by the analytical work of the complete Working Group reports. An independent review of the FAR will advance public deliberation about the extent of potential future climate change and clarify the basis for various policy strategies. Because advance drafts of the FAR are available for outside review (the report of Working Group I is already out; Working Groups II and III will be released for review shortly), a concurrent review of the FAR is feasible for the first time.

From our earlier discussions of climate modeling (with both yourself and Prof. North), I developed considerable respect for the integrity with which your lab approaches the characterization of climate modeling data. We are hoping to sponsor a paper by you and Prof. North that thoughtfully explores the limitations of climate model outputs as they pertain to the development of climate policy (as opposed to the utility of climate models in more theoretical climate research). In particular, we are looking for an author who can write a well-supported but accessible discussion of which elements of climate modeling have demonstrated predictive value that might make them policy-relevant and which elements of climate modeling have less levels of predictive utility, and hence, less utility in developing climate policy. If you are interested in the idea, or have thoughts about who else might be interested, please give Ken Green a call at your convenience.

If you and Prof. North are agreeable to being authors, AEI will offer an honoraria of $10,000. The essay should be in the range of 7,500 to 10,000 words, though it can be longer. The deadline for a complete draft will be December 15, 2007. We intend to hold a series of small conferences and seminars in Washington and elsewhere to coincide with the release of both the FAR and our assessment in the Spring or Summer of 2007, for which we can provide travel expenses and additional honoraria if you are able to participate.

Please feel free to contact us with questions and thoughts on this invitation.

Cordially,

KENNETH GREEN, PH.D.
Visiting Scholar.

STEVEN F. HAYWARD, PH.D.
Resident Scholar.

The CHAIRMAN. This letter is addressed to Professor Steve Schroeder, dated July 5, 2006, on the letterhead of the American Enterprise Institute, and signed by Dr. Steven Haywood and Dr. Kenneth Green.

Dr. Rowland, have you seen this type of letter?

Dr. ROWLAND. I did see that letter. A couple of days ago.

The CHAIRMAN. And what are your thoughts on this letter?

Dr. ROWLAND. I think it illustrates the problem of getting science out in an understandable fashion in Washington, D.C., where there are many competing sources—many of them with money—that put out steady information that affect the general public's view of what is going on.

Within the scientific community, with its refereed publications, there has been very little denial or avoidance of the realization that global warming is actually happening. The question of details is always valid, but the fact that Alaska is showing all of these signs of increasing temperature, makes me say simply that global warming is occurring. Our problem now is, what can we do to slow it down, to adapt to it, to mitigate. But, we have to take very seriously the fact that it's happening.

The CHAIRMAN. Do you see this letter as an attempt to bribe scientists to manufacture criticism of the IPCC report conclusions?

Dr. ROWLAND. I think that the question of who is a scientist and what they believe is a very broad-ranging one. There are undoubtedly people that will respond to this, that have their own beliefs. What I'm saying is that the overwhelming opinion of the scientists that have spent their discussions trying to understand it, say global warming is occurring. There certainly are facets that need to be explored, but using the existing knowledge to denigrate the IPCC, I think, is unfortunate. But it's something that will go on. We need to keep in mind that the scientific community has tried to do the best they can on this, and is putting out their result in the IPCC reports. And I would urge people to examine the science as discussed there, rather than what appears in other less scientific sources.

The CHAIRMAN. Thank you very much.

Mr. Piltz, I just have a few minutes left. What are your thoughts on the letter?

Mr. PILTZ. On the letter? Yes, I saw an example of that letter last year when it was going around, one of the leading scientists shared it with me. I know that they were concerned about it. I hesitate to attribute motives to the sender of the letter. I do think it's important when you have the international science community, through the IPCC, or through other major assessments that are well-reviewed and well-vetted, that this is the material that those of us who are not necessarily climate science experts should use, and embrace.

And, I do think we have seen the beginnings of an orchestrated political effort to undermine the perception of the IPCC. Because the IPCC's conclusions about global climate change, and its implications, raise questions that could cause pressure for a stronger policy. And people who don't find that politically congenial do have an interest in somehow making it look like the IPCC is somehow controversial.

So, I was concerned, when I saw this. As to whether that was part of this sort of, denialist or contrarian or skeptic effort.

The CHAIRMAN. Dr. Mahoney, do you think that if we follow the path we're following, we're on a path to destruction that's irreversible?

Dr. MAHONEY. Mr. Chairman, yes I do. I think that the timescale over which that, the word you use was destruction, would

occur, is something that needs to continue to have sharpened—more and more sharp definition in time. So, I think that is—the way I view what we do with the science now, I think the last few years have seen a real coalescence of the science on the fundamental issue that humans are a principle cause of the climate change that we're seeing.

We could refer back many years, and many scientists would say we already had a consensus, but I think it's fair to say that that consensus has become more firm and more broad in the last very few years. And so now, I look at the science as appropriately turning its attention to what I described in a lecture last week, for example, is the very important differential questions: What impacts are the most severe, and when are they likely to occur? What's our confidence in that because we have to pay special attention that, if we estimate a time too long, we're in grave trouble, of course. What mitigation measures would help the most, and when and where do they need to be applied?

So, I think I see something of the nature of a sea change in the science, where we can turn away from this fundamental yes or no, is there any human influence—the answer is yes. But now we have an even greater challenge for the science, which is to say—let us really get on about figuring out, with the best confidence we can, when changes are likely to occur, and what's our ability to forestall those changes by the various measures available to us.

The CHAIRMAN. One last question.

In my four decades of experience in the Senate, I have observed that people of the United States begin to act when they get scared, or there's something they fear down the road. Most people will conclude that at this moment they have not reached that level of fright regarding climate change. When will something happen where people will come to this level of fright? Dr. Rowland?

Dr. ROWLAND. I will resort to discussing an earlier problem—that of stratospheric ozone depletion, where the question of what should be done was being discussed back and forth. The United States in that case took action in 1976, while the rest of the world—except for Scandinavia—was not aggressively pursuing the problem, until suddenly the Antarctic ozone hole appeared. This manifestation of loss of ozone—in a distant location, but with massive loss there, suddenly raised the attention of everybody, saying, "We don't understand it completely, but this sudden change to the Earth seems to have been done by man," That realization led very quickly to the Montreal Protocol, and to the toughening of the controls on chlorofluorocarbons, in fact, their elimination by 1996, as far as manufacture.

The important consequence there was, in fact, the appearance of something totally unpredicted. I'm afraid, that that's what the likelihood will be on global warming. Something will happen that we haven't really factored in, that is even more serious than the things that we have seen. Sea level will rise gradually, but something else—I'm still concerned about that. There are enough changes going on to be very worried just by what we see. But, we don't know, we don't understand the Earth system completely, and so maybe something else will happen, too.

The CHAIRMAN. If this was an issue of great concern and fright, these seats would have been filled here.

Senator Stevens?

Thank you very much.

Senator STEVENS. Thank you.

I do have another conflict, as I told the Chairman, let me just ask a general question or two.

We've been pursuing this subject at the Arctic Institute, International Arctic Research Commission in Fairbanks for some time. And, with the cooperation of the Congress, we've put vessels out on the Arctic Ocean for the last 4 years to measure the change in temperature, and to really follow the change in the ice, as it shifted around in the Arctic Ocean.

As I said in my opening statement, I've been told that the oscillations in both the Atlantic and Pacific have increased the temperature of the water going into the Arctic Ocean, and that had a lot to do with this disappearance, or the starting of the disappearance of the Arctic Ice. We've had some predictions that it might be as early as 2040, others told us it would be 2320—so, we've had a whole series of predictions here.

Beyond that, I'm told now that because of that increase in temperature of the Arctic, both the Russian and Alaska ice is thinning and the permafrost is starting to melt and recede, and as it does, it's releasing a great deal of methane emissions. And, that the studies show that not only that, it contributes to methane, but the increased cultivation of the lands of the Earth is adding a great deal of methane, and the chart I saw showed that the methane spike was greater than all of the other greenhouse gases together.

Now, I'm looking at this from the point of view of our safety. Some people are suggesting, "Let's just put a blanket over Alaska, and don't let them develop anything more." We have 34,000 trillion cubic feet of gas. We have half of the Nation's supply of coal. We have more oil and gas out on the Outer Continental Shelf, we have two-thirds of the Continental Shelf.

Now, our future, I think, needs some of that energy, but at the same time, these other issues are coming up about greenhouse gases, and I wonder two things: One, is it possible to capture some of that methane as the permafrost in Russia and the U.S. subsides? I'm told that's increasing annually, the amounts that are being released. On the other hand, is it possible to convince the farm community that there ought to be some different way of using fertilizer, so that the methane doesn't come from the farm community? And, do any of you conclude that the people who say we should shut down Alaska are right?

Now, it's a hard job to represent a State that's one-fifth the size of the United States and we have three Representatives in Congress. We find that out too often. Now, the Chairman says, is anyone scared? I'm scared. And I've changed my policy on the concepts of the CAFE standards—I want to know what else we can do to convince the rest of the country that this is a serious question, and action should be taken?

And I can go back—is it possible to trap some of this methane as it escapes? I'm told if we could refine that methane, it would be

a very good fuel, better than some of the other gases and petroleum. But, it's escaping.

Dr. ROWLAND. I don't think that it is possible to trap the methane from such widespread sources. However, I do have to say that our own global methane measurements have shown that the amount of methane in the atmosphere, the yearly increase, has been slowing down for the last few years. There has been very little change in the global amount since the year 2000. This leveling off shows up in our data, and it shows up in the NOAA data from Boulder, Colorado. We're trying to understand why the increase in the amount of methane in the atmosphere has slowed down. I attribute part of this to places where people have been capping off leakage, because they realize that methane can be—if it is trapped and prevented from escaping, then they can sell it as a fuel.

Senator STEVENS. That's what I'm saying, can we do that in the Arctic?

Dr. ROWLAND. I don't think you can, unless it's a very concentrated source. I don't think you can do it with cows or rice paddies, which are other sources.

What can be done is with that part that's already under the control of mankind—namely the oil and gas industry. We went into the Southwest United States into Oklahoma and Texas and Kansas, and found that there were a lot of hydrocarbon leakages there. And that seems to be something, a very positive thing that we can do, that is to look all over the U.S., and all over the world, for that matter—about those places where we have methane already under control, but are letting it escape because it leaks away. That's something that I think might counteract very strongly the tendency toward increases in the amount of methane in the atmosphere.

Senator STEVENS. Well, what about—I've got to leave, this is my last question, I'm really late now—what about the impact of the oscillation of the Atlantic and the Pacific? The heat in the Arctic Ocean? That's not man-made, that came from the sun.

Dr. ROWLAND. That's not man-made, but the consequences of it are spread very widely. It's only when you have something already in a controlled fashion that you do well in improving our control.

Senator STEVENS. Well, thank you all, I do have some questions to submit for the record, also, and I look forward to reading some of the documents that you submitted for the record. I appreciate it very much, Senator.

The CHAIRMAN. Thank you very much.

Senator Lautenberg?

Senator LAUTENBERG. Thanks, Mr. Chairman, and thanks to all of you for the work that you've done, and for bringing your views, even though we have a contrary analysis of what a couple have said. After having heard so much about the intimidation of science, and scientists and their effort to tell it like it is, very frankly.

Mr. Knutson, you said that NOAA had sent Public Affairs officers to monitor comments that you would be making to the press—what do you think, once again—what was their intention? Did they just want to listen to you? You have a lot of intelligent knowledge, did they just want to hear?

Mr. KNUTSON. I'd rather not speculate on their motives. I can say that they did not interfere with what I said in these appearances,

but I know a number of scientists have commented that this just seems to not be right, that it seems—some call this activity "minders"—having minders come around to see what see what we say, and sort of monitor us.

Senator LAUTENBERG. You're generous in your views.

Mr. Piltz?

Mr. PILTZ. Well, how Mr. Knutson was dealt with by the NOAA political structure has been revealed—at least to some extent—by internal e-mail traffic that was obtained by Freedom of Information Act requests, and it was—in particular—after Hurricane Katrina and toward the end of the 2005 hurricane season when NOAA was, this was very much in the media, and there was the question of, does the intensity of this hurricane activity have something to do with global warming? Clearly, it was on the public's mind. And the NOAA leadership was doing a press wrap-up on the season and all of that, and it seemed to me, there was clearly an effort to selectively put forward certain scientists at NOAA and keep others out of the media, in such as way as to sort of sever the link in the public mind between increased hurricane intensity and global warming.

Tom Knutson's work was climate modeling projections that showed that under business-as-usual greenhouse gas scenarios, that over the course of the 21st century, more and more of our hurricanes would be category four and category five.

There was a political operative at the Department of Commerce who, in collusion with the NOAA Press Office, didn't want Tom Knutson giving interviews to the press in which he would describe his work. And instead, they selectively put forward people from the weather service who said, "We don't see any connection." It's a tremendous—it's a really amazing example of the mismanagement, misrepresentation of the state of knowledge on this issue, selectively, by the NOAA leadership.

Senator LAUTENBERG. We have documents that show redaction and changes in wording that "could be dangerous, might be dangerous," or "is dangerous"—what does that say? Is there any possibility that this was just innocent scribbling?

Dr. Mahoney?

Dr. MAHONEY. No, Senator. Senator, no—I don't think those comments were made where they were, or they were offered as editorial comments. I don't think they were offered simply to try to pick one word over another, I think they were attempts to create a more moderate picture, or a less dangerous picture. If I pick up on the Chairman's words, the issue is how much would the public be scared by some of these things? I have no doubt that some people interpret their, did interpret their jobs as—among other things—aimed toward reducing, what I call, the "fear factor." I'm just quoting that here, I'm not saying that's a phrase in common use about it. And that would be a reason that some editorial comments would be reflected that way.

I do think there's another matter that is important in context to this, Senator, if I could add to that. Some documents are meant to be project reports, or planning documents or things of that sort. And, I saw occasions to my views, since this—much of this came to my attention—where some, including among working scientists,

would see in the case of a document, the opportunity to editorialize, somewhat, by pointing out the great problems that might occur. Because, after all, each of us as individuals have our thoughts and feelings—we may feel this is highly possible, or not, in some cases.

So, from the perspective of trying to create a plan document, or an overall project report document, I would find that I would try to be very careful to avoid extremes at either end. And the extreme at the one end would be that which, would be attempts to take out all the scary words. The extreme at the other end would be that, that would say, "The sky is falling," when it may not be appropriate to say that. So, I——

Senator LAUTENBERG. Well, it certainly doesn't seem to have been a journalistic exercise, to improve the quality of the language. I mean, it's obviously designed to change what's being said into something less, something different.

And, Mr. Piltz, do you want to make a last comment, before I get chastised by the Chairman?

Mr. PILTZ. Yes, Senator, if I could just comment on that. I worked for the Climate Change Science Program for 10 years, and I worked with career science professionals throughout the agencies, putting together 9 editions of the annual report of the Program to Congress, *Our Changing Planet.* It's not a technical document, it's a communication to Congress and to a wider audience, but it had many state of knowledge statements in it.

I'm not a scientist, but I worked with 90 career science professionals, with them clearing every step of the way, to put together the most careful, reviewed language on what was understood, the highlights of recent research, and what the issues were.

And, that—once that had been cleared by the science professionals—and I was accountable to them at every step of the way, it would go to the White House for final review and clearance. And there, political gatekeepers would step in. And most notably, the Council on Environmental Quality, the Chief-of-Staff for several years there was a former oil industry lobbyist, who clearly had a political agenda.

And, I think, if you kind of look at the process, he was not accountable back to the science community, his proposed edits didn't have to be vetted by anyone, there was some pushing and pulling as to exactly how much of it to take, but I think that if you put it in front of the scientists and say, "Was this editing that enhanced the quality of the scientific communication, or made it more accurate?" I think you will find that the answer was no.

And so, I don't think it was a question of toning down extremes. I think it was a question of White House misrepresentation of language that had been agreed upon by science professionals.

Senator LAUTENBERG. I will close with this, Mr. Chairman. I have a report submitted from the U.S. Climate Change Science Program in 2003, and it starts with, "Warming will also cause reductions in mountain glaciers, advance the timing of the melt of mountain snow, of snow packs in polar regions," *et cetera, et cetera.* And the entire paragraph is deleted, by Mr. Cooney, I believe. And, I mean, that evidence is hardly circumstantial. This is a gross attempt not to furnish the information as it was developed, period.

Mr. PILTZ. I think it was generally understood among people in the program that there was something about this process that wasn't completely on the up-and-up. Everyone has a right to comment, but I think under the previous Administration, comments of as little merit as we were seeing would have been flat-out rejected by the Program Office, and they would have been backed up by the White House Science Office, and here, a lot of that stuff was being allowed to go through. And I—I think that the science leadership was trying to hold the line, but they were really under a tremendous amount of White House pressure. That's why the National Assessment got suppressed, they're not even allowed to talk about that, to this day.

Senator LAUTENBERG. Mr. Chairman, thank you very much. It will be on us if we don't listen to what we're hearing these days.

Thank you very much.

The CHAIRMAN. Thank you very much, Senator Lautenberg. I'd like to recognize Senator Nelson, but before I do, I'd like to note that Senator Nelson is an astronaut, he worked on NASA issues for several years. And, as all of you aware, in research of this problem, climate change, the bulk of the money is in NASA. And his subcommittee is the one that authorizes the funding for research for NASA. So, he's a kingpin.

Senator Nelson?

STATEMENT OF HON. BILL NELSON, U.S. SENATOR FROM FLORIDA

Senator NELSON. Well, thank you, Mr. Chairman. And, I would describe myself as a lieutenant of Senator Inouye, and it is a privilege. Thank you for this opportunity.

Thank you all for your public service.

Dr. Griffin, the Administrator for NASA, assures me that this attempted muzzling of scientists at NASA has stopped. I would like to know your observations. Does anybody disagree with that?

[No response.]

Senator NELSON. Does that mean you all agree that the muzzling has stopped? I mean, this kind of nonsense is going to stop.

Dr. MAHONEY. Senator, I think I could comment, certainly for myself, and just by noting the affiliation of others around the table. We all may hear things generally, I don't think we have a close-in observer of NASA practices these days. My—all that I've heard is that there's been a major improvement in recent times. But, I don't think that there's a strong oversight role here in the—at the witness table at the moment.

Senator NELSON. Mr. Piltz?

Mr. PILTZ. The last four pages of my written testimony submission, Senator, is a memorandum prepared by the Legal Director of the Government Accountability Project, with which I'm affiliated, on the NASA media policy. And, we do acknowledge that there has been a significant improvement in the ability of NASA scientists' ability to communicate.

However, there are problems with that media policy. There are hidden traps in it that could be used, there are issues having to do with the protections under the Whistleblower Protection Act that are not fully incorporated into that policy, and I'm not tech-

nical on this issue, but I commend it to your attention, and the Committee's for your consideration.

Senator NELSON. OK, we will follow up on that. It's my judgment that Dr. Griffin wants to exorcise any of that political restraint on scientists in his agency, and I certainly want to assist him in making sure that that's the case.

Now, at least NASA has come out with a communications policy, which you refer to. Tell me, Dr. Brennan, why hasn't NOAA come out with such policy?

Dr. BRENNAN. Well, sir, thank you for the question. As I indicated in my statement, the Department of Commerce is in the process of finalizing a revised policy that overcomes some inconsistent and confusing communication policies from several Administrations ago.

One of the things I think is important to bear in mind, sir, is that the Department of Commerce has not just NOAA in its operational science and forecasting-type of capability, it also has the scientific measurement, precision measurement of the National Institutes of Standards and Technology, it has the population dynamic research and science of the Census Bureau, Economic Analyses and Forecasting, so it has a wide array of scientific disciplines, and consequently, it has a much more difficult matter of developing a policy that will be applicable throughout that range of disciplines.

Nevertheless, sir, and I think it has been pointed out here, the Department has put together a policy that provides an opportunity for scientists to address their scientific findings, without the interference of the Public Affairs, if they so choose—a policy that has an appeals process, so that if there's any concern, there's a rapid means of addressing that, and also a robust training program so that any mistakes that have been made in the past can be overcome, and we can set this behind us.

Senator NELSON. Well, I just heard what you said, with regard to all of the multiplicity of disciplines, and so forth, but what we're trying to get at is that scientists are not politically intimidated. We want that intimidation dead. As former Congresswoman Carrie Meeks said, "Black Flag dead." And, I would assume that you bringing out a policy that everybody can see would be important. So, when do we expect that policy to come?

Dr. BRENNAN. Sir, it's my understanding that it will be issued in the next couple of weeks.

Again, sir, several scientists throughout the agencies participated in several rounds and iterations and developments, and have made this a much-improved product.

Senator NELSON. All right, let's talk about the cooperation between NASA and NOAA.

There was a pretty rocky time, back a few years ago, and that particularly came out with regard to the GOES and the POESS. No, the GOES and the POESS satellites were the ones that we had pretty good coordination. But, a few years ago as you worked to this new system called NPOESS, we had a pretty rocky time in coordination.

Are NASA and NOAA beginning to cooperate a little better?

Dr. ANTHES. An important part of our recommendation to OSTP was to develop a national strategy so that we have a long-term

plan for Earth observations that would involve both NASA and NOAA in a more coordinated fashion. There is definitely room for improvement in the relationship between NASA and NOAA in terms of transitioning research observations into operational observations. So, we're recommending that a national plan be developed which transcends Administrations and Congresses and develops a long-term plan for sustained Earth observations for both research, operations, and applications.

Senator NELSON. Is there anything that needs to be done (from your recommendation to us) in our oversight capacity with regard to the leadership of those two organizations to get them to get along better?

Dr. ANTHES. It's difficult to legislate individuals to get along. That's why our recommendation to OSTP is to develop a process that transcends whoever's in power at the moment in the two agencies, so that it's not a matter of people getting along personally, but a plan that's in the national interest, regardless of who's in charge.

Senator NELSON. It is my understanding, and it is certainly my hope, that Dr. Griffin and the Admiral are having a fairly good, open line of communication, working on this system now. Is that translating down into the lower structure of the bureaucracy in those two agencies?

Dr. ANTHES. Well, you'd have to ask the lower structures of the bureaucracy.

Senator NELSON. What's your observation, is what I'm trying to get.

Dr. ANTHES. In terms of our report, it's too early to see if there will be any action. But there definitely needs to be action. That's why we're recommending these 17 missions to both NOAA and NASA, and we certainly hope the two agencies get together and do something. This does not require a huge amount of money. To do the incremental program requires about $2.50 per person in the United States. That's an inexpensive visit to the coffee shop. So, this can be done, and nothing is more important. The Nation is at risk by our diminishment of satellite observations.

Senator NELSON. Mr. Chairman, I have two more questions, I'll be happy to wait until after Senator Kerry has finished.

Senator KERRY. I'm happy to have you finish.

Senator NELSON. All right, let me ask you again, Dr. Anthes, what essential space-based measurement capabilities are going to be lost in the coming decade, and what is the impact on climate research?

Dr. ANTHES. Well, a number of observations are being degraded, and some are being lost. For example, ocean altimetry, measuring the sea level height, a very important variable for monitoring climate change, how fast the sea level is rising.

Vertical profiles of ozone are being lost. The atmospheric sounding capability, the vertical profiling capability of temperature and water vapors is being seriously degraded—not completely lost, but being degraded. The loss of these capabilities will affect, not only our measurements of how climate is changing in all regions of the world, but also the prediction by the numerical models of hurricanes and other severe storms.

So, it's a whole suite of observations, scores of them which are either being degraded, or lost completely.

The important thing is that it is the system of these observations that is important. It's not just one single type of observation, it's how they all work together that counts. It is like taking a measurement of your body's health. You don't want to just measure one part of the body, you have to understand and measure the whole body.

So, that's what we're talking about—it's important to measure the entire Earth with a suite of observations, that puts the picture together of how the whole planet is changing. That's what we're recommending.

Senator NELSON. Mr. Chairman, that's where I want to sound the alarm bell. Because it is in the degrading of those systems that we're losing our ability to measure the changes, which is the very subject of this hearing. And, yet global warming is the reason we need to have those assets up there. And, they're degrading.

We've had the Triana satellite spacecraft, sitting in a can waiting to be launched for several years. One of its functions would be to measure the heat of the Earth, which just happens to dovetail with the subject that we've been discussing here, global warming.

What do you think about that?

Dr. ANTHES. Well, you have to measure, you have to know how much energy the sun is putting out, You have to measure, also, how much the Earth is radiating back. The balance of these two is responsible for global warming. Right now, there's a net surplus of energy coming into the Earth. So, to separate the factors of solar variability, greenhouse gas increases and other contributions such as changing soil moisture, changing reflectivity of clouds, melting ice, and so forth, you have to measure the radiation coming back from the planet.

So, yes, if you don't measure these essential climate forcing functions, you're not going to be able to understand what's happening now, what's happened in the past, and certainly what is likely to happen in the future.

Senator NELSON. Mr. Chairman, that's about $150 million launch cost for that Triana satellite, it's sitting there. It's built and under the present constraints of NASA, they have difficulty coming up with that money for launching. We may want to look to see outside of the budget of NASA, or create an add for that, but also that's not to minimize all of these other systems.

And, my final question Dr., Mr. Piltz—or I guess it's Dr. Piltz?

Mr. PILTZ. Mr. Piltz.

Senator NELSON. All right. Tell us what you think about the budget trend for climate research, being consistent or inconsistent with the scientific importance of this work?

Mr. PILTZ. Well, whenever it's criticized, this Administration likes to say, "Well, we spend a whole lot of money on research." And it is a big research program, and it's a fine research program, it's worthy of bipartisan support. But this Administration has been systematically cutting the budget for the Climate Change Science Program, in the Fiscal Year 2008 request, it's down almost 30 percent in real terms, from just 4 years ago, in 2004. That is a radical cutback. And most of that can be accounted for by the NASA sci-

entific research, and especially global observing system budget. This is a major problem. It's not a $2 billion program anymore, it's a $1.5 billion program, and it was that in 1991, when it was just ramping up as a new start under then-President Bush.

If I could just add one recommendation for your oversight on the NPOESS crisis, there is a joint document, December 2006, prepared by NASA Earth Science Division, and the NOAA Climate Observations and Analysis Program that describes in detail the impacts of the Nunn-McCurdy certification of NPOESS on the Climate Program goals of NASA and NOAA. I do not think this document has been released, but—but it describes in stark terms, in NPOESS the Pentagon dumping the climate sensors off the next generation of environmental satellites—that is the future of the climate-observing system. And, we have a major problem.

I recommend that, if you do oversight on this, that you not limit yourself to hearing testimony only from Administration political appointees, such as the NASA Administrator and the NOAA Administrator, the Director of OSTP. I mean, they're committed to advancing, you know, White House policy and political objectives, and they'll tend to put the best face on a bad situation, and perhaps be less than fully forthcoming with the Committee in calling things to your attention.

I recommend that you hear from and ask the tough questions of people who wrote that joint report to the White House. Bring in people like Tom Karl of the NOAA National Climactic Data Center, the Director there, or Jack Kaye, of the NASA Earth Science Division, and get them to tell you a straight story.

Senator NELSON. Thank you for that recommendation. We'll follow up on that.

Thank you, Mr. Chairman.

Thank you, Senator Kerry.

The CHAIRMAN. And now I'd like to call upon a recognized leader in this area of concern, Senator Kerry.

Senator KERRY. Thank you, Mr. Chairman, very, very much.

Gentlemen, I apologize for not being able to be here during your testimonies, because we had a competing hearing in the Finance Committee on the budget. But, I did get a summary of each of them from my staff, so I'm aware of what you said, pretty much, and will follow up on a few of the things that you did say, and go to a few other places, too, if I can.

Mr. Piltz, let me just confirm with you—you were the coordinator of the National Assessment, you coordinated the agencies that put together the National Assessment for the year 2000, correct?

Mr. PILTZ. I did not have operational responsibility for the National Assessment. It was coordinated out of the office that I worked in. The National Assessment Coordinator, Dr. Michael McCracken, had a separate staff within the program that I worked in. And I was working on the annual reports to Congress, and other things. I was very closely attuned to what was happening with that, I was in on the early planning meetings, I saw the whole process by which the National Assessment was developed, I went to the meetings of the synthesis team and the regional workshops around the country, and I saw exactly what happened to it, under the Bush Administration, from practically the day——

Senator KERRY. You described that earlier. Precisely what happened to it? Would you describe it right now?

Mr. PILTZ. Well, as early as 2001, and much more aggressively from the middle of 2002 onward, the Administration moved to first ignore and then actively suppress the—they disbanded the whole National Assessment process, this nationwide expert-stakeholder dialogue that was the intelligence gathering, diagnosis capability. And, they literally suppressed the use of the report, for any—I mean, not just as a policy document, which it wasn't, but even for research planning.

I was directed by the White House Science Office to delete the section on the National Assessment from the annual report to Congress in the year it came out, and then from the middle of 2002 onward, we had a very strong push to take it out of the Strategic Plan, and——

Senator KERRY. Did they tell you why they wanted you to take it out? Were you given any reasons?

Mr. PILTZ. No, there is—the Administration has never gone on record with any reason for why there is anything wrong with the National Assessment. It has been used by the IPCC, it has been used by the Academy, it has been praised by the Academy, and no scientific or intellectual justification has been given for why this would not be playing a significant role in research planning and decision-support activities. Not just the original document, which is 6 years old now, but the whole process that it initiated, of unfettered communication.

No, there's never been, I mean—I think it's evident that the reasons were politically driven, rather than scientifically justified. I think it's generally understood within the Program.

Senator KERRY. And as you say, it was generally understood—what was the understanding about what the political reasons were?

Mr. PILTZ. Well, you know, Dr. Mahoney could probably address this too, but I—it was my——

Senator KERRY. He's smiling, he's looking forward to doing that. [Laughter.]

Mr. PILTZ. It was my understanding—and I was not in the room when high Administration officials decided this, I just saw the fallout from it—but it is my understanding that the White House directed the CCSP leadership, and in particular, it's my understanding that Phil Cooney at CEQ was the proximate White House political operative agent. But just as an operative in a chain of command that went all the way to the top—directing the CCSP leadership that we weren't going to be using this report, discussing it, putting it in the Strategic Plan, and making it very clear that we were not going to go forward with another integrated National Assessment process.

And that was transmitted, then, to the agencies by the, at the principals level.

Senator KERRY. How many years had you worked there?

Mr. PILTZ. Ten years.

Senator KERRY. What was your background before that?

Mr. PILTZ. Well, I had been working on the collision between science and policy on global warming since I first moved to Washington in 1988, the same week as the famous hearing where Jim

Hansen testified. I was on the staff of the House Science Committee for 4 years, 1991 to 1994, I'm—my academic training is as a social scientist. At this point I know a lot more science than most policy people, and a lot more politics than most scientists, so I'm in between those two worlds.

Senator KERRY. And what do you think has been the consequence for our country of this flat-Earth approach to the science and the global warming issue itself, global climate change?

Mr. PILTZ. Well, you know, the Administration has had many mechanisms, I mean, there's the National Assessment, there's the keeping scientists away from the media, there are some disappearing websites, there are these pre-clearances—it goes on and on—ignoring the Arctic Assessment, it just depends on what they need to do. But, the net effect of it, is rather than to embrace the scientific assessment and use that to drive effective response strategies, it's somehow worrying about trying to make the science communication conform to a pre-determined political position, that might be threatened by a more straightforward science communication.

Senator KERRY. What would you call that?

Mr. PILTZ. What would I call it?

Senator KERRY. What's the—I mean, what's the rationale?

Mr. PILTZ. I believe that, sir, when the President is asked about global warming, and says, "Yes, the Earth is warming, fundamental debate—is it man-made or natural?" That's not a fundamental debate in the science community. And, I mean, you ask me what would I call it? I call it misrepresenting the intelligence.

Senator KERRY. Dr. Mahoney, your testimony, your written testimony, leads one to believe that there had been no real occurrences where NOAA scientists have been prevented from speaking freely regarding their scientific findings to the media, is that really your opinion?

Dr. MAHONEY. No, it isn't, Senator, and I don't think I said that.

Senator KERRY. Well, just in the written testimony, it doesn't make it explicit. Could you make it explicit here, now? Are there instances where scientific findings have been prevented from being spoken about to the media by scientists, by NOAA scientists?

Dr. MAHONEY. What I think has occurred, Senator, in some cases is, in the process of interacting with the Public Affairs representatives in NOAA in particular, there's a perception developed that some of the scientists were discouraged, or at least not encouraged, and in some cases discouraged from carrying out interviews with the media. In some cases, interviews that might have been set up were denied by the Public Affairs Office representatives and the like. And, I certainly saw instances of that during my time at NOAA.

Senator KERRY. Dr. Anthes, you said in your testimony that we need to restore U.S. leadership on Earth science, and that the Bush cuts to NOAA and NASA have hurt us. The cuts are about 30 percent, aren't they?

Dr. ANTHES. The cuts in NASA are about 30 percent, and in real purchasing power, from the value as recent as the year 2000. So, this is a 30 percent cut in the Earth science research. And you can look forward, into the future, and see that there are almost no

plans in NASA for additional missions to study the Earth from space. I showed a chart in my testimony that shows the number of instruments was decreasing from about 120 last year, to something like 80 in 3 years from now, and then on down to 50 percent by 2015. So, unless things are turned around, there is a huge shift away from Earth science and observations from space, which are needed more than ever. This is not the time to be cutting back on observations, it's the time to restore them and restore the U.S. to a leadership capability.

Senator KERRY. Well now, each of you with one exception, have testified here to the need to commit to science. What we have on the record here is a picture of this Administration willfully, purposefully, quashing science from reaching the American people. Willfully stepping in the way of legitimate global climate change conclusions being drawn. Willfully stepping in the way of proactive steps to try to deal with this. In effect, a dodge and a duck, an avoidance of reality. That's the conclusion you have to draw from scientists being told, "Don't talk about it," words being stripped out of reports, and budgets being cut.

Dr. Brennan, what's your response to that? Are you proud of a record of the last 6 years that sees the United States falling behind the rest of the world, avoiding science, and not telling the American people the truth?

Dr. BRENNAN. Thanks, sir. My response to that is that the United States is the lead in advancing climate science, as I testified, the United States involvement in the world——

Senator KERRY. How can you be the lead in advancing climate science if—I mean, I was here with Senator Hollings, as Senator Inouye was, when we passed the Global Change Research Act, 1990. And we specifically set out the following, "at least every 4 years, to give us the National Scientific Assessment. To integrate, evaluate, interpret research findings on climate change, scientific uncertainties, analyze the effects of global climate change on the natural environment, agriculture, energy production, use, land and water resources, transportation, human health, welfare, human social systems, biological diversity, analyze current trends in global change, both human inducted and natural." Don't you think that if the IPCC report comes out in 2001, if you guys were serious about this, that you might have reported to the Congress after that your judgments about that report?

Dr. BRENNAN. Sir, as you know the Administration, utilizing the CCSP process, is advancing the 21 Synthesis and Assessment Reports to advance our understanding of a science that is developing and evolving very rapidly, and it provides a very direct way to get advances to——

Senator KERRY. Well, let me ask you about your understanding. Do you accept the scientific consensus that since the Industrial Revolution, the planet has warmed up by 0.8 degrees Centigrade, do you accept that?

Dr. BRENNAN. I accept that the scientific consensus that unequivocally indicates that the Earth is warming, and that there are anthropogenic causes for that.

Senator KERRY. Do you accept the science that says that that carbon dioxide that is already in the atmosphere, coupled with

other greenhouse gas will continue to do damage for its half-life of whatever, 70 years or more, and that therefore, no matter what we do, there will be another add-on of temperature increase to somewhere in the vicinity of 1.5 degrees centigrade, do you accept that?

Dr. BRENNAN. I accept that we are continuing to add emissions to our environment——

Senator KERRY. That's not what I asked you. I asked you whether or not the existing levels, no matter what is added, just what is there now, pre-ordains a continued increase in temperature up to about 1.5 degrees, do you accept that?

Dr. BRENNAN. I accept that we have carbon increasing in our atmosphere, sir, yes.

Senator KERRY. So, you accept that we're stuck with that increase in temperature, no matter what we do?

Dr. BRENNAN. No, I believe that the temperature will continue to increase.

Senator KERRY. Fair enough. And, do you accept the consensus of the scientific community are now ratified by what was put out in Paris last week, that we can no longer afford the cushion of a temperature increase up to 3 degrees centigrade, we are now stuck with a 2 degree, sort of, precautionary level, which leaves us now with a margin of 1.5 to 2 degrees. That everything man-made that we do, in India, in China, here, the entire cushion available to us is a 0.5 degree, do you accept that science?

Dr. BRENNAN. I agree that the cushion available to us is narrow, sir. And the Administration supports the IPCC report.

Senator KERRY. If that's the case, where is the plan for this Administration to cut carbon? To cap carbon? To reduce carbon? To the levels that will hold us to 450 parts per million, which is the scientifically agreed-upon level that we must accept. Where's the plan?

Dr. BRENNAN. Sir, the Administration has been developing and has a plan, and has been working to reduce greenhouse gas intensity, it has been working to address the fuel side to reduce emissions, to stop emissions, and then to reverse——

Senator KERRY. Sir, with all due respect, that's just talk. There's no real plan to hold carbon emissions to a 450 parts per million level. The President's State of the Union message suggested some gasoline savings, which is good, and he suggested some alternative fuels. None of which get you close to the level of 450 parts per million. And I just talked to a number of scientists last week, who confirmed that we can no longer afford the 550 parts per million they thought we could, they've ratcheted it down, why? Because of the evidence of the break-up of the ice, what is happening across the planet. Now, do you guys take that seriously, or don't you?

Dr. BRENNAN. Absolutely, sir.

Senator KERRY. Well, if you take it seriously, where's the assessment to the American people of what we have to do to deal with this?

Dr. BRENNAN. Sir, as I said, the Administration is producing the 21 Synthesis and Assessment products to advance our understanding of these impacts.

Senator KERRY. With all due respect, it's been over 5 years since the last report, and it is unclear when 19 further reports of those

21 are going to be due. Totally unclear. Do you really believe that two reports in two separate areas is sufficient to say that after 6 years you're doing the job, here?

Dr. BRENNAN. Sir, these reports are on a schedule for completion that will be submitted to you in a timely fashion to address the issues that have been raised, and to support the Administration's view that this is the most appropriate way to advance the scientific understanding.

Senator KERRY. This is where I am. I will acknowledge that there is no computer model that tells us precisely what's going to happen. I understand that. I also have read enough to understand that there's certain cooling that takes place, there are particulates in the atmosphere, the cooling is now neutralized, and equals—if you take all of the greenhouse gases—except for carbon dioxide—there's sort of an equilibrium.

But then you've got the carbon dioxide outside of that. There's been a 35 percent increase in carbon dioxide since the beginning of the Industrial Revolution. I'm not a scientist, but I know enough to connect the dots here, that when I've got all these scientists screaming at me, saying, "Precautionary principle, you gotta do this, we gotta hold it to 450 parts per million, we've lowered our estimate, we're now looking at devastation, permafrost melting in Alaska, huge, 66-square mile sheet of ice breaks off, creates its own island," you know, it's all accelerated. The glaciers of the planet are melting, not just in our own part, all over the planet. Every indicator is leading to this. An Arctic bird was discovered down in San Diego a few weeks ago, I mean, you run the gamut.

You guys aren't responding to it. I have to tell you this.

Dr. BRENNAN. Sir, I believe we share a common goal in reducing these emissions, and the approach——

Senator KERRY. No, I don't think we do share that, because you fought against Senator McCain's and my efforts to have increased CAFE standards a few years ago, the most we could get was 35 votes in the Congress. You weren't there, you didn't stand for it, the President didn't, you're not supportive of this.

And I think it is the most serious dereliction of public responsibility that I've ever seen. Ever. When scientists are told, "Don't tell the American people the truth," I mean, this is serious stuff. In all of the years I've been on this Committee, I've never seen something like this. Where an Administration is unwilling to pull people together and say, "How are we going to do this?"

When I was a Lieutenant Governor back in the 1980s, I had the privilege of chairing the only Governor's task force in the country chaired by a Lieutenant Governor, and I met with John Sununu—then the Governor of New Hampshire, and with Dick Celeste, then-Governor of Ohio. And we patched together the sulfur plan for acid rain, which was then the great concern. And we are the ones who sort of created the whole emissions trading concept, which was originally put in for acid rain.

In 1990, I remember, the very industry that is now standing up against it fought us tooth and nail. And they said, "Don't do this to us, it's going to cost $8 billion, and you can't do it in the timeframe you're setting." The environmental community came in and said, "It's not going to cost $8 billion, it's going to cost $4 billion,

and we can do it in half the time." And guess what? Thanks to John Sununu, EPA Administrator Bill Reilly, and President George Herbert Walker Bush, who was responsible about it, we passed it. We did it, and we did it in half the time that the environmental community predicted, and at half the cost. Because no one could predict what would happen when you started down that road of targets, goals, mandates, and technology that was tried to meet them. And there's a progressive gain in technology that we can't predict today.

You folks are not leading this country to a place where we can embrace that, and go do that, with alternatives, efficiency, renewables. And, we still hear you fighting about Kyoto, which we're way beyond, at this point.

I know we can pontificate up here, and that's all we get, sitting here as a Senator. And we can try and take something to the floor. But I've got to tell you, in my judgment in 22 years here, you're not doing your job. The Administration's not doing its job. This is a disgrace. You are turning your backs on future generations in this country. And, you are potentially inviting the possibility of global catastrophe, which will cost millions of lives, spread disease, destroy species, destroy land, you've got 100 million people living within 3 feet of sea level in buildings in Shanghai, in New York, in Boston, and other similar places, and you're just inviting this potential catastrophe.

I think you ought to go out, and you can protest and sit there and say you're doing it. You're not doing it. And I invite you to go back and talk to your people back there, and take a look at what your public responsibility is.

Is there anybody here who disagrees? Mr. Piltz?

Mr. PILTZ. I don't disagree. But I would say, Dr. Brennan's a Deputy Assistant Secretary of Commerce. I understand the White House Office of Science and Technology Policy declined an invitation to testify at this hearing, and they left Dr. Brennan hanging out here to get beat up.

Senator KERRY. You're good to support him.

Mr. PILTZ. The problem is—the power——

Senator KERRY. I understand, folks, this is the forum we have, but this is deadly, serious stuff. This is the most serious thing I see. This is, what, how many years now of hearings on this Committee, since 1987—almost 20 years. Almost 20 years of hearings on this Committee, when we've been talking about this very science.

We need a carbon cap, we've got to reduce carbon. We've got to get serious about putting incentives in our automobiles to be hybrids, and plug-ins and all kinds of things. We've got to move now to clean coal technology. There are 16 coal-fired plants that they're planning to build in Texas under TXU, without new source performance standards, they're going to put 78 million tons of additional CO_2 into the atmosphere. China is building one coal-fired plant per week. That can't happen.

And we better show the global leadership to prevent it from happening. And I don't care if people get tired of me ranting on this, I'm going to rant on this every day I can for the next—for the time I'm here. Because this is the most serious issue we have.

Thank you, Mr. Chairman.

Senator NELSON. Mr. Chairman. I would recommend, as a result of what we've heard today that we, you—our Chairman—invite the testimony from OSTP that could not appear today. So that we can get more at the Administration's agenda with regard to this. Because, I think the things that Senator Kerry has said are scientifically obvious. And time is running out.

The CHAIRMAN. I can assure you, that we will make another attempt to invite those witnesses.

In the meantime, the record will be kept open for 2 weeks. So, if you have any changes you would like to make in your statement, or if you want to have addendums made, please feel free to do so.

We will also have 2 weeks to submit questions, and we hope that you will be responding to them.

I thank you very much, and the meeting is adjourned.

(Whereupon, at 12:20 p.m., the hearing was adjourned.)

A P P E N D I X

PREPARED STATEMENT OF HON. MARK PRYOR, U.S. SENATOR FROM ARKANSAS

Thank you Mr. Chairman. This is a very important topic and the necessity for a fair and open discussion of scientific investigations and their results extends beyond today's topic of climate change and affects many other areas of public policy. It is common practice in science to challenge and test new results and through this process of verification, acceptance, and rejection come to a consensus. We are fortunate in the United States, and throughout most of the world, to have a system of peer review whereby good science and bad science can be equally debated. Sometimes these scientific debates can take decades before there is agreement, especially in a new field such as climate change where a great deal of science still needs to be performed and much needs to be learned.

What is not acceptable is for people and organizations to try to influence the scientific debate by exerting undo influence on scientists or distorting their results. Dr. Alfred Sommers, former Dean of the Johns Hopkins University School of Public Health summed up my feelings when he said:

> "We have a uniquely non-politicized peer review scientific establishment in this country. My concern is that politicization is accretive in nature. If it goes on long enough it becomes the norm, and even a new Administration eight or 12 years from now will just accept it." [1]

There is a growing body of scientific evidence that significant global warming is occurring and that worldwide industrialization over the past century is a contributing factor. Last week the Intergovernmental Panel on Climate Change (IPCC) issued a report on the physical science basis for climate change. One of their conclusions is that most of the temperature change is very likely, meaning a 90 percent certainty, due to increased levels of atmospheric greenhouse gases. What is less clear, and still needs to be investigated, is what will be the affect of climate change on the Earth. This very important debate can only take place if scientists are allowed to freely voice their concerns, conduct their research, and publish their results without fear of pressure or interference.

Again, I thank the Chairman for holding this hearing and 1 look forward to hearing the testimonies of the witnesses.

PREPARED STATEMENT OF PETER H. GLEICK, PH.D., PRESIDENT, PACIFIC INSTITUTE; MACARTHUR FELLOW; MEMBER, U.S. NATIONAL ACADEMY OF SCIENCE

Threats to the Integrity of Science

Senators, thank you for the opportunity to provide testimony today on the critical issue of the integrity of science. Good, independent science—indeed, good information in general—is crucial to making good political decisions. It is difficult enough to make intelligent policy choices given the complexities of today's political, environmental, economic, and social challenges. It is almost impossible when good science or data are ignored or distorted, or when bad science is sought out, to support predetermined political conclusions. Yet never have the political abuses and misuses of science seemed as pervasive and intentional as they have over the past few years.

The United States has a long and proud non-partisan tradition of scientific research, analysis, and support. As far back as the American Revolution, Benjamin Franklin embodied the ideal of integrating a passion for science and fact with diplomacy and politics. This tradition continued through more than two centuries of advances in both science and in the tools and avenues for moving scientific information into the policy arena. By the end of the 20th century, institutions like the White House Office of Science and Technology Policy (OSTP), the President's

[1] Johns Hopkins Magazine, *Political Science,* November 2004, Vol 56, No. 5.

Science Advisor, the Office of Technology Assessment (OTA), the National Academies of Sciences and Engineering (NAS and NAE), national laboratories and universities, and even the media, were considered vital, independent sources of information, fact, and analysis needed across the political spectrum for making smart policies.

For the last several years, there have been growing indications of systematic challenges and threats at the Federal level to the integrity of the scientific process using a variety of strategies and tactics. Independent government review organizations and advisory boards have been disbanded. Access to data and information has been reduced. Federal scientists have been muzzled. Scientific reputations, rather than scientific evidence itself, have been questioned. Scientific analyses and conclusions, prepared within Federal agencies or by people outside of government, have been changed for political and ideological reasons by people who have not done the scientific work. Work by partisan organizations has been substituted for work by nonpartisan scientists.

The Pacific Institute and its *Integrity of Science* program[1] has been cataloging and evaluating threats in the areas of environmental problems, energy policy, human health, and national security. My testimony today will offer a framework (see *Table 1,* below) for better understanding and categorizing these threats. I also offer a few specific examples and cases that may offer some insights into how Congress might act to once again support the use of science in informing and setting policy.

Scientific Misconduct and Altering Good Science

Policymakers have the right to make decisions that consider, but then discount, good science. Science is, after all, only one factor among many that must be weighed in making policy. But they have no right to seek bad science to support predetermined conclusions, to misrepresent, misquote, misuse, or suppress science that contradicts those conclusions, or to penalize scientists who seek to inform and educate the public.

Equally important, political operatives and appointees must not be permitted to alter scientific findings and edit scientific conclusions to support pre-determined outcomes, as has recently been reported in the fields of climate change, the health effects of pollution, and the need to protect threatened animals and plants under the Endangered Species Act.

Suppressing or Limiting Good Science

Access to information is a cornerstone of good policy. Efforts by outside parties, or Federal agencies, to restrict or limit access to information are particularly damaging in a democratic society. These efforts take different forms. Access to good science can be limited through changes in funding to selectively collect, fail to collect, or reduce access to certain kinds of data. Recent changes in funding have reduced the ability of the United States to collect data on environmental issues, to analyze data that are collected, and to disseminate information to the public. For example, the decision to close Environmental Protection Agency libraries in major cities (such as Washington, Chicago, Dallas, and Kansas City) would cut the availability of scientific information, data, and reports available to the public. Funding cuts for satellite instrumentation to monitor the Earth's climate will hinder the development of intelligent climate policy.

Scientific Policy Misconduct

Ensuring that science is made available to policymakers has long been a challenge. In recent years, however, certain actions have made it more difficult for independent, nonpartisan science to reach Congress and decisionmakers. The loss of the Office of Technology Assessment has crippled Congress's ability to analyze information, receive independent advice, and make thoughtful decisions on vital technological questions.

The recent disbanding of a wide range of independent advisory committees, or efforts to pack them with ideological allies, weakens the policy process. For example, the Secretary of Health and Human Services (DIMS) disbanded the National Human Research Protections Advisory Committee and DHHS's Advisory Committee on Genetic Testing. Fifteen of the 18 members of the Advisory Committee to the Director of the National Center for Environmental Health (NCEH) were replaced, many with scientists with stronger ties to industries that may be regulated or in

[1] The Pacific Institute, founded in 1987, is an independent, non-partisan policy research center. For details, see *www.pacinst.org.*

leadership positions of organizations opposed to public health and environmental regulation.[2]

The U.S. Department of Energy's principal outside advisory board on scientific and technical matters, in place for more than a quarter century, was recently disbanded. The independent committee set up by Congress to advise the government on the safety of the Nation's nuclear weapons stockpile has been eliminated.[3] The Secretary of Health and Human Services disbanded advisory committees that provided oversight on genetic testing and the use of humans in research. A nominee to the Army Science Board was rejected by the current Administration because he was thought (incorrectly it turns out) to have contributed to the Presidential campaign of another Republican candidate for President. All of these actions have the effect of reducing the quantity and quality of independent scientific advice that reaches decisionmakers.

Arguments From Ideology

There is, unfortunately, a long history of policy arguments made from ideological or religious perspectives that result in attempts to discredit contradictory scientific information. The classic example, of course, is the order that Galileo Galilei, the famous Italian physicist, astronomer, and philosopher, stand trial on suspicion of heresy in 1633. The charges stemmed from Galileo's research and writings that supported the idea that the Earth moved around the Sun, rather than the understanding of the time that the Earth was fixed in the heavens, derived from literal readings of the Bible. The idea that the Sun was stationary was condemned as "formally heretical" and Galileo was required to recant his ideas, subjected to house arrest for the remainder of his life, and had all his publications banned. As Galileo said: "I do not feel obliged to believe that the same God who has endowed us with sense, reason, and intellect has intended us to forgo their use."

More recently, biology in the Soviet Union during the 1930s and later periods was crippled when control and direction of state research was given to T.D. Lysenko who rejected the science of genetics for ideological reasons. Between 1934 and 1940, under Lysenko's admonitions and with the approval of Stalin, many geneticists were executed or sent to labor camps.

In the United States, ideological arguments that lead to the rejection of scientific information and conclusions, and contribute to public confusion and policy disarray, are still seen in disputes over evolution, climate change, sex education, and various health research efforts, such as stem cells. The inability to believe or accept something because of ideological or religious contradictions says nothing about the accuracy or truth of scientific findings.

Ad Hominem; Personal Attacks

An unusual and disturbing trend can be seen in efforts to discredit scientists on personal grounds, rather than on challenges to science. Such personal attacks have no place in public discourse. In the world of political spin and hypocrisy, we've also seen pundits attempt to paint all scientists as ideologues who twist their science to fit preconceived political preferences.[4] Scientists make errors; indeed some let ideology trump evidence. But these scientists cannot long escape the proper functioning of the scientific process. Fraud, abuse, and error are found out, revealed, and discredited.

Scientists, including this witness, have been threatened with lawsuits for offering public opinions on controversial issues to reporters.[5] But there is a difference between scientists who distort their work and produce bad science based on pre-conceived political positions, and scientists who are willing to share peer-reviewed results with the public and policymakers. The former are fortunately rare and almost always discovered and discredited by the normal scientific process; the latter are not common enough and they should be encouraged, not discouraged.

Blanket attempts to discredit good science and scientists who attempt to inform the public and policymakers must be challenged. Similarly, officials who open "investigations" of scientists, who reach conclusions that differ from their own do a disservice to science, unless there is evidence of wrongdoing.

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[2] Michaels, D. et al. 2002. "Advice Without Dissent. Editorial. *Science,* Volume 298, No. 5594, p. 703, October 25, 2002.

[3] J. Dawson, "Disbanding NNSA Advisory Panel Raises Concerns, *Physics Today,* September 2003.

[4] See, for example, P. Noonan, "The Heat is On." *Wall Street Journal,* July 20, 2006.

[5] See "Science, Climate Change, and Censorship," The Pacific Institute, Patrick Michaels, and Climate Change. *http://www.pacinst.org/press_center/censorship/*.

Misuse of Uncertainty and Arguments From Consensus

Finally, there is a serious misunderstanding among some policymakers of the nature of scientific certainty and knowledge, and a corresponding misuse of uncertainty. Absolute certainty in science, or even in politics, is a rare luxury, and never guaranteed. Insisting that scientists provide certainty before setting vital public policy is a recipe for inaction and delay. As Dr. Stephen Jay Gould said, "In science, 'fact' can only mean 'confirmed to such a degree that it would be perverse to withhold provisional assent.' I suppose that apples might start to rise tomorrow, but the possibility does not merit equal time in physics classrooms. Yet political strategists often publicly recommend using uncertainty to delay actions long past the time when scientists believe we know enough to act.[6] The issue of climate change is an example of this, where the misuse of uncertainty has delayed national action long past the time when effective policies were needed.

Similarly, there is confusion all along the political spectrum on the issue of "consensus" in science. A "consensus" among scientists does not make an issue true or false. It is a reflection of the best scientific understanding at the time. For example, an argument is often made in the context of global climate change that very large numbers of climate scientists believe in climate change; therefore it must be a serious problem. This is backward: climate change is a serious problem because of the mass of scientific evidence that underlies those beliefs, and it is that evidence that produces the consensus of opinion. The strength of the argument comes from the science itself, not the consensus.

Summary

In the long run, the truth of whether the Earth is round (mostly), goes around the sun (so the best evidence shows), or is warming due to industrial activity (considered "very likely" *i.e.,* more than 90 percent certainty) will be demonstrated on the global stage. Our job as scientists is to seek the best understanding of the world around us and to communicate that understanding to the public. Your job as elected officials is to encourage scientists to give you their best understanding, fund new science if there are gaps vital for the public interest, to weigh scientific information, and then to make decisions. Short-term political or economic advantage must be trumped by our collective responsibilities to protect public health, the environment, and our national security and to ensure that our decisions are informed by the best available information.

Specific Recommendations

Congress can act to help restore confidence in the integrity of science and to reduce threats to science and scientists working to advise policymakers and the public:

- Reinstate independent advisory committees to Congress and to Federal agencies.
- Require that no political litmus tests be imposed on advisory committee appointees.
- Guarantee open public access to government studies, data, and scientific fmdings.
- Require transparency of information on conflicts of interest.
- Prohibit Federal agencies and employees from modifying, censoring, or altering scientific findings.
- Re-establish and adequately fund an independent advisory organization to Congress on technology and science issues.

Thank you for the opportunity to present this testimony to you, and for entering it in the record.

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[6] See, for example, the call to make scientific uncertainty a key part of the climate debate by Luntz Research Companies. 2002. "The Environment: A Cleaner, Healthier, and Safer America." Memorandum for GOP Congressional Candidates. p.137. *http://www.ewg.org/briefings/luntzmemo/pdf/LuntzResearch__—environment.pdf.* See also the statement by the Tobacco Institute of Hong Kong, "The view that smoking causes specific diseases remains an opinion or a judgment, and not an established scientific fact. Tobacco Institute of Hong Kong Limited, 1989, March.

TABLE 1—CATEGORIES OF DECEITFUL TACTICS AND ABUSE OF THE SCIENTIFIC PROCESS (SOURCE: P.H. GLEICK, PACIFIC INSTITUTE, 2007)

There are many tactics used to argue for or against scientific conclusions that are inappropriate, involve deceit, or directly abuse the scientific process.

Appeal to Emotion

This is a large category and involves using various tactics to incite emotions in people in order to persuade them that a particular argument or hypothesis is true or false, independent of the scientific evidence:

Appeal to Fear
Appeal to Flattery
Appeal to Pity
Appeal to Ridicule
Appeal to Spite

Personal ("Ad Hominem") Attacks

This approach uses attacks against the character, circumstances, or motives of a person in order to discredit their argument or claim, independent of the scientific evidence.

Demonization
Guilt by Association
Challenge to Motive (such as greed or funding)

Mischaracterizations of an Argument

This approach typically mischaracterizes an issue or evidence and then argues against the mischaracterization. It can include:

Begging the Question

Circular Reasoning

Partial Truths

Selective Choice of Problems

Straw Man Argument (includes substituting a distorted, exaggerated, or misrepresented position for the one being argued)

Loaded Question (includes posing a question with an implied position that the opponent does not have)

False Dichotomy (for or against)/False dilemma (includes assuming that there are only two possible opinions or choices)

Misplaced Burden of Proof

Confusing Cause and Effect

Red Herring (includes presentation of an irrelevant topic to divert attention from another topic)

Slippery Slope (includes the assertion that one event must inevitably follow from another)

Inappropriate Generalization

Accusing all of a group of people or arguments or set of facts as having the characteristics of a subset of that group.

Misuse of Facts

Numerical Mischaracterization
Selective Choice or Presentation of Data; Biased Sample
Inadequate Sample; Hasty Generalization; Leaping to a Conclusion
Selective Omissions of Data
Illusory Precision (where precision isn't needed or available)
Inappropriate Vagueness (where precision is needed)
Unrelated Facts (bringing unrelated facts that seem to support a conclusion)

Misuse of Uncertainty

Misplaced Certainty
Misrepresentation of Uncertainty

False Authority

Including appeal to authority not competent to address issue:

Hidden Value Judgments

Including judgments based on ideological or religious rationales rather than reviewable and testable evidence.

Scientific Misconduct

The violation of the standard codes of scholarly conduct and ethical behavior in professional scientific research, including:

Fabrication (the fabrication of research data and observations)

Falsification (manipulation of research data and processes or omitting critical data or results)

Failure to Acknowledge and Correct Errors

Science Policy Misconduct

The manipulation of the process of integrating science and policy, including:

Packing Advisory Boards
Imposing Litmus Tests
Altering or Suppressing Information
Bullying of Scientists
Selective Funding or De-funding

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARK PRYOR TO DR. WILLIAM BRENNAN

Question 1. Last year there was an article in Nature questioning whether NOAA was accurately presenting the conclusions of its researchers regarding the possibility that global warming could be affecting the severity and frequency of hurricanes. The article states that in May 2006 an internal panel, chaired by Dr. Leetma of NOAA, prepared a statement on the current stats of the science and that the statement did not contain any policy recommendations. Why did NOAA management request that the statement be made "less technical?"

Answer. The two-page Frequently Asked Questions (FAQ) document on Atlantic Hurricanes and Climate was a summary of existing scientific research containing no new science, but rather detailing the current state of science on hurricane activity and climate. The first draft used technical phrases which may not have been readily understood by a wide variety of audiences. The changes recommended did not change the scientific findings, but rather were intended to provide clarity and additional context to make the document more accessible to lay audiences.

Question 2. What is the status of the statement?

Answer. The FAQ document is updated as new and relevant information becomes available, and was last updated on December 12, 2006.

Question 3. Was it ever publicly released?

Answer. Yes. The two-page FAQ document on *Atlantic Hurricanes and Climate* was publicly released on September 27, 2006, and was last updated on December 12, 2006. The FAQ document is available at *http://hurricanes.noaa.gov/pdf/hurricanes-and-climate-change-09-2006.pdf*.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUYE TO RICHARD A. ANTHES, PH.D.

Question 1. The Climate Change Science Program budget shows a steady decline in funding from approximately $2B in FY 2004 to $1.5B proposed for FY 2008. NASA's Space Based Observation Program has been particularly hard hit, going from $1.01B in FY 2004 to a projected $576M in FY 2007. How has this substantial decrease in the CCSP budget affected funding decisions with the agencies?

Answer. The CCSP wrote a Strategic Plan in July 2003. The NRC's 2004 review of the Plan said that the program would require significant new funds to fulfill its mandate. But, the funding profile has gone in the opposite direction. In this era of declining funds, agencies have tried to cobble together the resources to simply maintain core, activities, but have not been able to take on many new activities that this Nation dearly needs.

For example, the Strategic Plan said that we would improve understanding of the economics of climate change, which now is the issue of the time regarding climate change. We have only the vaguest understanding of the costs and benefits of climate change and mitigation and adaptation options. The CCSP should be able to address these and other areas that relate to trillion dollar decisions, but it does not have

the resources to do this. As another example, the Strategic Plan said that the U.S. was going to do a much better job of providing information to inform decisions at a variety of scales and for a variety of sectors. The CCSP has not had the funds to do that. A final example I will give is the demanifestation of climate sensors/capabilities associated with NPOESS, which has seriously jeopardized the ability to measure long-term trends. This was a major concern addressed in our Decoded Survey report.

Overall I am deeply concerned about the health of the Nation's climate program. We are hearing that "the science is settled—now is the time for action." While I agree with the latter part of this statement, the former can be grossly misleading. The Nation needs the science now more than ever. The world is committed to climate change, which will affect many things that we require or hold dear, *e.g.,* water, ecosystem services, etc. This speaks to the essential need to adapt to climate change. But, our ability to adapt wisely is significantly limited by the state of the science. For example, we simply don't know whether precipitation will increase or decrease over most of the United States—an absolutely fundamental gap in our understanding related to adaptation. The CCSP does not have the funds to address these and other areas that relate directly to trillion dollar decisions. In brief it is imperative that "action" *must* involve a strengthened observation, research, decision support, and communication enterprise—the four pillars of the CCSP.

Question 2. Who is making the decisions regarding which sensors are in the national interest and will be kept on NPOESS?

Answer. I assume the ultimate decision will be by the Administrator of NOAA, in consultation with DOD (which shares NPOESS costs with NOAA), and with ultimate approval by Congress.

Question 3. Last week you were in Washington, D.C. to brief policymakers on the National Research Council report. The report recommends a path forward that restores U.S. leadership in Earth Science and Applications and calls for NASA and NOAA to undertake a series of 17 specific missions over the next decade. What has been the response from NASA, NOAA and OSTP to the report and its recommendations?

Answer. There has been no formal reaction as yet, although the agencies have formally acknowledged receipt of the report and thanked the NRC for its work. There have been many informal contacts and conversations with certain NASA, NOAA, and OSTP officials that have been positive and hopeful. The response from the Congress, the science community and the media has been generally very positive. Dr. Mike Freilich, the director of NASA's Earth Science Division has publicly praised the report, and we understand front his recent Senate testimony that he is looking to prepare a roadmap guided by the report recommendations, and based on more detailed studies of the mission concepts at NASA field centers. What Dr. Freilich cannot do, however, is change the budgetary reality.

The Administrator of NASA, Dr. Mike Griffin, has made remarks that suggest he does not support the recommendations of the report. In his recent testimony regarding the NASA budget Dr. Griffin, has made it clear that his priorities remain centered around human exploration. Ills assessment of the Earth science program as "in good shape" suggests that he will attempt to implement only that portion of the report recommendations which can be accomplished within existing and currently planned Earth science funding levels. The President's FY 2008 request for the NASA budget shows a continuing decline of the Earth Science budget after a small increase in FY 2008. According to decadal survey cost estimates, this approach would likely only result in implementing a very small fraction of the recommended missions (perhaps 3–4 of the 15 missions recommended for NASA).

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. TED STEVENS TO RICHARD A. ANTHES, PH.D.

Question. I understand that the recent Intergovernmental Panel on Climate Change report concludes that much of the warming over the past 50 years is caused by humans. I am concerned about human-caused factors. However, I am also interested in the effects of natural causes such as solar flares and the impact of the Pacific and Atlantic decadal oscillations. Do you feel enough has been done to examine the impacts of natural factors on climate change?

Answer. Thank you Senator Stevens for your excellent question.

The short answer is that while increased effort on understanding both natural and anthropogenic climate change and variability, especially on regional and local scales where they matter most to people is needed, we know enough already to con-

clude that the human effects on climate change are now outweighing natural (non-human) effects.

The IPCC has concluded that *most* of the observed global temperature increase in the past 50 years is "very likely" due to human activity. This conclusion is based on studies that assess the causes of climate change, first considering all the possible agents of climate change (forcings), both natural and from human activities. The capability of climate models to simulate the past climate is also assessed, given both the observations and estimates of past forcings, and the climate changes. Given good replications of the past, the forcings can be inserted one by one to study their individual effects and allow attribution of the observed climate change to the different forcings.

The best climate models have been extensively tested and evaluated using observations. They are exceedingly useful instruments for carrying out numerical climate experiments, but they are not perfect, and some models are better than others. Uncertainties arise from shortcomings in our understanding of climate processes operating in the atmosphere, ocean, land and cryosphere, and how to best represent those processes in models. Yet, in spite of these uncertainties, today's best climate models are now able to reproduce the climate of the past century, and simulations of the evolution of global surface temperature over the past millennium are consistent with paleoclimate reconstructions.

As a result, climate modelers are able to test the role of various forcings in producing observed changes in climate. Forcings imposed on the climate system are both natural in origin, such as changes in solar luminosity or volcanic eruptions, or human-induced, such as increases in aerosol and greenhouse gas concentrations in the atmosphere. *Climate model simulations that account for such changes have now reliably shown that global surface warming of recent decades is a response to the increased concentrations of greenhouse gases and sulfate aerosols in the atmosphere.* When the models are run without these forcing changes, the remaining natural forcings and intrinsic natural variability fail to capture the increase in global surface temperatures. But when the anthropogenic forcings are included, the models simulate the observed global temperature record with impressive accuracy.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUYE TO RICK PILTZ

Question 1. Last year, in response to a letter from Senator McCain, the National Science Board recommended that all Federal agencies that conduct research establish clear policies and procedures for presenting their data. Both NASA and NOAA have taken steps to revise and clarify their respective media policy.

Should Congress establish a consistent Federal policy regarding the dissemination of research by Federal employees? What should be the criteria for such policy? And is there a good model that can be used across the Federal Government?

Answer. I am most familiar with the problems related to communication of climate and global change research, though I believe my response is of more general applicability.

Several scientific information pathways should be considered in establishing policy on the dissemination of research conducted by Federal employees. They include *media communications, Congressional communications* (hearing testimony and reports), *public communications* (presentations, lectures, websites, brochures, *etc.*), *professional communications* (*i.e.,* primarily scientific publications, but also conferences), and major *scientific assessment reports.* These pathways have key elements in common but are not identical in the issues they raise for policymaking.

Federal policy regarding the dissemination of research by Federal employees must include certain consistent, government-wide safeguards. However, given the diversity of participating research agencies, a one-size-fits-all policy may not be the best approach for addressing the full range of pathways of science communication. In addition, functional and organizational differences within a particular agency may warrant somewhat different requirements.

In general, any government-wide policy should specify what category or categories of communication it is addressing, specify the purpose of the policy (*i.e.,* to promote the communication of research), acknowledge the broad statutory and constitutional rights held by Federal scientists (and other Federal employees), address the employees' obligations, lay out a grievance and reporting system, and define a baseline of protections. Detailed implementation of any government-wide policy should then be developed as appropriate by individual agencies.

Recommendations for Executive Branch Agencies on Ensuring the Integrity of the Dissemination of Climate Change Research [1]

1. Eliminate pre-approval, routing, intake, anticipated Q&A, and monitoring requirements for agency media, and, where applicable, Climate Change Science Program (CCSP) communications.

The ultimate decision about the content of and parties to any particular media communication should rest with the reporter and the scientist he or she requests. Public Affairs Offices (PAO) should take an active role in coordinating and facilitating media interactions, especially connecting journalists with the appropriate scientists and supplying corrections and background information. It may be reasonable to require notification of the PAO and a post-interview recap, as many local PAOs have done to the scientists' and reporters' satisfaction.

2. Reaffirm the "personal views" exception for all media, Congressional, public, and professional communications.

Scientists must be apprised of their constitutional right to speak about any subject, including policy-related matters and those outside their area of expertise, so long as:

- Scientists make it clear that they do so in their private capacity, not as a representative of their agency. Identifying the scientist with his or her agency, position, and area of expertise is permissible so long as the communication includes the "private capacity" disclaimer; and
- Scientists' personal communications do not unreasonably take from agency time and resources. Personal use of telephone or e-mail should be allowed during employees' "paid free time." Longer interviews may need to be conducted during authorized breaks or after work. Insofar as the agency facility is usually open to the public, reporters should be able to interview with scientists on the premises.

3. Comply with the mandatory requirements of the Anti-Gag Statute to notify employees of their whistleblower and related rights by incorporating the statutorily-prescribed addendum into the text of any restrictive communication policy or directive.

4. Comply with the Whistleblower Protection Act (WPA) by including the necessary exceptions.

The Whistleblower Protection Act protects any unclassified disclosures, or those not specifically prohibited by statute, that a Federal employee reasonably believes is evidence of illegality, gross waste, gross mismanagement, abuse of power, or substantial and specific danger to public health or safety. Communication policies should include this exception to any restrictions it imposes.

5. Eliminate communications restrictions based on the "Sensitive but Unclassified" (SBU) classification.

The unsettled legal definition of SBU can cover virtually any form of communication and thereby implicates constitutional and statutory free speech concerns. Correspondingly, regulations governing the definition of "Sensitive but Unclassified" and related categories must be tightened so that employees know what type of information is properly marked SBU.

6. Guarantee the timely and proactive release of press releases.

Any scientist, whether they are lead or co-author of a published report, study, or article, should be given the necessary approval and assistance to issue a press release within a reasonable time and concurrent with the publication date—even if a release has already been or will be issued by another institution.

7. Leave content editing to the scientists for scientific publications, Congressional written testimony and reports, web postings and presentation material, and press releases.

Although non-scientists and agency management may be actively involved in copy-editing and proof-reading, they should not have the authority to alter the substance of written scientific information without the scientists' expressed approval. The qualified scientists actively involved in the research or synthesis of research alone should be responsible for its content. Co-authors, peer review, ethics, and personal reputation are the proper check.

8. Reaffirm a scientist's "right of last review" for all media, Congressional, public, and professional communications.

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[1] These recommendations for Executive Branch agencies follow closely those made by the Government Accountability Project, as contained in GAP's report, *Redacting the Science of Climate Change: An Investigative and Synthesis Report* (March 2007), by Tarek Maasarani.

Federal employees should have the right to approve the scientific content in the final version of any proposed Federal publication that significantly relies on their research, identifies them as a lead author or contributor, or purports to represent their scientific opinion. This includes, but is not limited to, reports, web postings, and press releases. In the case of multi-author publications, co-authors should have a meaningful right of review and comment. Where an agency adopts an agency-wide position on a scientific issue, scientists should be allowed to register their disagreement publicly and without consequence. Finally, Federal employees should be permitted reasonable access to all drafts and edits of their publications produced throughout the review process.

9. Solicit the input of scientists and other stakeholders in the development of the content of substantial Congressional and public reports and the procedures that govern their production.

10. Continue to ensure that Federal employees are not restricted either from publishing their research in peer-reviewed journals and other scientific publications or from making oral presentations about their research at professional conferences or other meetings of their peers.

11. Establish effective transparency and accountability procedures.

In order to make the above two recommendations meaningful:

- The editing and review process must clearly identify all participants and text changes in each stage of review. Participants must be able to address any concerns or questions about changes with the party that made them;
- An internal disclosure system must be established to allow for the confidential reporting and meaningful resolution of inappropriate alterations, conduct, or conflicts of interest in the review process in particular; and
- More generally, the government and its agencies must afford Federal scientists adequate whistleblower safeguards, including protections from retaliation, the impartial investigation and fair resolution of complaints, due process rights, confidentiality of disclosures, and adequate corrective relief.

12. Adequately inform and clarify scientists' rights and responsibilities.

Every public affairs office should evaluate its existing policies and develop (or reaffirm) a set of simple and unambiguous policies in light of these recommendations and with the input of their own scientists. These policies should clearly incorporate the scientists' rights, as well as responsibilities, and be broadly disseminated to both scientists and management through annual reports, Internet sites, employment contracts, workplace posters, employee handbooks, and special trainings. Although agency- or department-wide policies may articulate an overarching set of principles and basic rights and responsibilities, it is suggested that implementation guidelines should be afforded some measure of adaptability to the particular needs of agency subdivisions. In any case, communications policies should be uniformly applied and readily available to all employees and the general public.

13. Investigate and correct the inappropriate policies, practices, and incidents identified in the Government Accountability Project report, *Redacting the Science of Climate Change,* and identified in other sources.

Determine whether and why the reported problems have occurred. Where confirmed to be true, provide:

- Adequate relief, including, but not limited to, reinstatement, public, and/or private acknowledgement to those who may have been harmed;
- Adequate discipline of those found responsible, including but not limited to firing or demoting them to a position of less authority; and
- Necessary reform to correct the institutional conditions, policies, and activities that prompted the problem.

14. Encourage the media to recognize and place primary emphasis on reporting credible peer-reviewed information from the scientific community.

15. Improve public affair's affirmative role of translating science for public consumption.

This includes:

- Mandating PAOs to aggressively pursue the dissemination and accessibility of their scientists' work to the public, media, and Congress;
- Regularly training scientists on effective communication techniques; and
- Hiring more local public affairs officers to work directly with the scientists.

16. Develop a transparent communications policy for the Climate Change Science Program that meets the recommendations for media policy reform set out above and that streamlines the approval process for CCSP products and communications.

17. End the suppression of meaningful and appropriate references to and use of the *National Assessment of the Potential Consequences of Climate Variability and Change* in the communication of climate change research and assessment, including in CCSP reports to Congress, research and assessment planning documents, and websites.

18. Ensure CCSP compliance with the Global Change Research Act by producing in the statutorily required timely and regular manner an integrated, scientifically-based assessment of climate and global change, including an analysis of current and projected trends, and with a focus on the impacts of climate and global change on society and the environment.

Recommendations for Action by Congress

1. Consider enacting legislation to ensure the integrity of the dissemination of research as outlined in the above recommendations.

2. Enact legislation to protect Federal free speech and whistleblower rights, with particular reference to employees of Federal science agencies.

3. Strengthen essential Congressional oversight functions on issues of scientific integrity.

Four Legal Cornerstones for Freedom of Speech in the Context of Scientific Freedom

A comprehensive approach to policymaking must include certain consistent, government-wide criteria for ensuring the integrity of the process for disseminating federally-funded scientific research. The Government Accountability Project calls attention to consensus, expert criteria that have existed since the issuance of the 1995 report of the Congressionally-charted HHS Commission on Research Integrity.

To summarize, those criteria require application of and compliance with four cornerstones for freedom of speech in the context of scientific freedom:

1. The First Amendment, with respect to the right of government scientists to express their personal views on their own time, without prior restraint or restriction of their anonymity, about matters of public concern;

2. The Lloyd-Lafollette Act of 1912, 5 USC 7211, which requires an unqualified, safe channel for government employees to communicate with Congress;

3. The Whistleblower Protection Act, 5 USC 2302(b)(8), the statutory application of constitutional free speech rights; and

4. the Anti-Gag Statute,[2] unanimously passed by Congress as part of every appropriations law since FY 1988, which bans spending to implement or enforce

[2] The current version can be found in Sec. 820 of the Transportation, Treasury, Housing and Urban Development, the Judiciary, and Independent Agencies Appropriations Act of 2006, which became Pub. L. 109–115 on November 30, 2005, and is extended through the current continuing resolution. SEC. 820. No funds appropriated in this or any other Act may be used to implement or enforce the agreements in Standard Forms 312 and 4414 of the Government or any other nondisclosure policy, form, or agreement if such policy, form, or agreement does not contain the following provisions: "These restrictions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by Executive Order No. 12958; section 7211 of title 5, United States Code (governing disclosures to Congress); section 1034 of title 10, United States Code, as amended by the Military Whistleblower Protection Act (governing disclosure to Congress by members of the military); section 2302(b)(8) of title 5, United States Code, as amended by the Whistleblower Protection Act (governing disclosures of illegality, waste, fraud, abuse or public health or safety threats); the Intelligence Identities Protection Act of 1982 (50 U.S.C. 421 *et seq.*) (governing disclosures that could expose confidential government agents); and the statutes which protect against disclosure that may compromise the national security, including sections 641, 793, 794, 798, and 952 of title 18, United States Code, and section 4(b) of the Subversive Activities Act of 1950 (50 U.S.C. 783(b)). The definitions, requirements, obligations, rights, sanctions, and liabilities created by said Executive Order and listed statutes are incorporated into this agreement and are controlling.": *Provided,* That notwithstanding the preceding paragraph, a nondisclosure policy form or agreement that is to be executed by a person connected with the conduct of an intelligence or intelligence-related activity, other than an employee or officer of the U.S. Government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement shall, at a minimum, require that the person will not disclose any classified information received in the course of such activity unless specifically authorized to do so by the U.S. Government. Such nondisclosure forms shall also make it clear that they do not bar disclosures to Congress or to an authorized official of an executive agency or the Department of Justice that are essential to reporting a substantial violation of law.

any nondisclosure policy, form or agreement unless it contains a Congressionally-drafted addendum that specifies the Whistleblower Protection Act and the Lloyd-Lafollette Act (protecting communications with Congress) prevail and supersede any conflicting language from the agency-based restriction.

The proper model is found in H.R. 985, which recently passed the House by a 331–94 vote. It provides a remedy for the Anti-Gag Statute, and in Section 13 reinforces the WPA with a scientific freedom amendment that makes the following actions legally-recognized "abuse of authority" and protects any government scientist from challenging:

"As used in section 2302(b)(8), the term 'abuse of authority' includes—

(1) any action that compromises the validity or accuracy of federally funded research or analysis;

(2) the dissemination of false or misleading scientific, medical, or technical information;

(3) any action that restricts or prevents an employee or any person performing federally funded research or analysis from publishing in peer-reviewed journals or other scientific publications or making oral presentations at professional society meetings or other meetings of their peers."

A further improvement could be to make those same actions illegal, so that a government scientist also could "walk the talk" and be legally-shielded from retaliation for refusing to obey orders implementing the above practices.

The Government Accountability Project's Model Media Policy

Section 1: Purpose

.01 This Order establishes this agency's media policy governing media communications including advisories, press releases, statements, interviews, news conferences, and other related media contacts. Public affairs offices have been established to facilitate the active dissemination of agency research results and to coordinate media and public relations activities. A principal goal of public affairs is to help the agency or program achieve its vision of a better informed society and of policy-making based on sound and objective science.

Section 2: Rights

.01 Scientists and other employees of the government have the fundamental right to express their personal views, provided they specify that they are not speaking on behalf of, or as a representative of, the agency, but rather in their private capacity. So long as this disclaimer is made, the employee is permitted to mention his or her institutional affiliation and position if this has helped inform his or her views on the matter. The employee is allowed to make reasonable use of agency time and resources for the purposes of expressing their personal views, *i.e.,* accommodations comparable to what would be allowed on other personal matters.

.02 Employees have the right of final review to approve and comment publicly upon the text of any proposed publication that significantly relies on or interprets their scientific research, identifies them as a lead author or contributor, or purports to represent their scientific opinion. In the case of multi-author publications, procedures should be set up to allow co-authors to have a meaningful right of review and comment.

.03 Final authority over the content of and parties to any particular media communication rests with the reporter and the scientist he or she requests.

Section 3: Responsibilities

.01 Public affairs is responsible for:

a. promoting media attention on important scientific and institutional developments,

b. coordinating journalists and the sources of information they are looking for, and

c. providing both reporters and scientists with timely, accurate, and professional media assistance.

.02 Employees are responsible for working with public affairs to make significant research developments accessible and comprehensible to the public.

.03 Employees are responsible for the accuracy and integrity of their communications and should not represent the agency on issues of politics or policy without prior approval from the PAO. Employees are not free to disclose classified information unless authorized by the U.S. Government or Federal statute.

Section 4: Guidelines for Media and Public Interactions

.01 To help public affairs best fulfill its responsibilities, employees are asked to:

a. keep the PAO informed of any media interest or potential for interest in your work, subject to the protections of the Whistleblower Protection Act.

b. notify the PAO of any impending media contacts and provide a recap afterwards.

c. request press releases from the PAO and submit drafts for review of their form and non-scientific content.

d. work with the PAO to review presentations or news conferences for their form and non-scientific content.

.02 Public affairs officers should

a. respond to all media inquiries within 120 minutes during the workday.

b. do all they can to help reporters get the appropriate information know the reporter's deadline to ensure timely response.

c. provide contact information where they will be available, even after hours, on weekends, and on holidays.

d. draft regional and national press releases whenever warranted.

e. ensure a timely turn-around on press releases over no more than 1 week.

f. develop or coordinate the development of talking points in collaboration with the relevant experts for the release of scientific papers and other agency products.

Section 5: Media Coverage

.01 In the spirit of openness, media representatives must be granted free access to open meetings of advisory committees and other meetings convened by this agency, as well as permission to reasonably use tape recorders, cameras, and electronic equipment for broadcast purposes.

.02 The PAO sponsoring or co-sponsoring a meeting may be present, or consulted, to undertake all responsibilities of a news media nature, including but not restricted to necessary physical arrangements.

.03 It shall be the responsibility of the servicing PAO to cooperate fully with and accede to all reasonable requests from news media representatives. In instances where conflicts or misunderstandings may arise from the expressed views, wishes, or demands on the part of news media representatives, such matters should be referred at once to the Director for resolution.

.04 The PAO Director shall exercise full authority and assume responsibility for all decisions involving the news media and related activity.

Section 6: Internal Reporting

.01 The agency will offer an internal disclosure system to allow for the confidential reporting and meaningful resolution of inappropriate alterations, conduct, or conflicts of interest that arise with regards to media communications.

Anti-Gag Addendum and Relevant Statutory Rights

[As explained in the previous section, "Four cornerstones for freedom of speech in the context of scientific freedom."]

Question 2. The Global Change Research Act of 1990 requires the Administration to prepare a *National Assessment of the Potential Consequences of Climate Variability and Change* "no less frequently than every 4 years." The only National Assessment produced was by the Clinton Administration. In 2005, the GAO concluded that the Bush Administration's plan to publish individual Synthesis and Assessment Reports did not meet the statutory mandate of the Act. In fact only one of the proposed twenty-one reports has been released. In your testimony you discuss the assessment's ability to provide response strategy options.

What were some of these options as listed in the last Assessment? Did the Assessment also include mitigation factors as well?

Answer. Due to the limited time and resources for many of the studies during the first cycle of National Assessment reports, response strategy options were often only touched upon without substantial development. However, there were a few well-funded studies that lasted long enough to start to get at these questions. I expect there would have been substantially more development of response strategy issues had the first reporting cycle—which produced the National Assessment Synthesis Team *Overview* and *Foundation* documents as well as a set of regional and sectoral reports—continued into an extended and ongoing assessment process as originally intended.

Thus, for example, in the Mid-Atlantic region (funded by EPA), a study was started along the southern New Jersey coast, working with stakeholders to consider how best to respond in the face of rising sea level (what areas to protect and how, what areas to agree could not be protected and would be transformed, *etc.*). EPA also funded a study for a few years along the Gulf Coast (Houston, the Louisiana delta region, and an area in the panhandle region of Florida), with the intention of working with stakeholders to analyze what could be done. But with the new Administration's completely non-supportive view of the National Assessment process, the study was modified to focus in a more limited way on the question of what information decisionmakers would need in order to address the issues. The impacts of climate variability and change on coastal ecosystems and communities is one key area in need of expert-stakeholder interaction to assess adaptation strategies.

Another general area is water resources. There have been studies about how water management should be adjusted in the face of El Niño/La Niña variations. It is my understanding that California, for which one of the National Assessment regional reports was developed, later launched a significant program for assessing the implications of climate change for water resources. Other regions should also be supported in developing this type of assessment activity.

The early impact studies have led the Department of Transportation to undertake efforts to investigate adjustments it needs to make. DOT has one study in the Louisiana delta region, and my understanding is that their workshops and other activities have identified a range of transportation infrastructure adaptation issues.

The first National Assessment report identified a wide range of potential consequences of climate change and, by implication, a wide range of potential adaptation response strategy issues facing policymakers and resource managers, region-by-region and sector-by-sector. In order to advance this work, the National Assessment process needs to be revitalized, with Federal support for a distributed process of expert assessment coupled with engagement with policymakers and other stakeholders.

The National Assessment process initiated in the late 1990s focused on projected change and impacts, pursuant to the requirements specified in the Global Change Research Act. The project did not address the complex issues of mitigation strategies to reduce greenhouse gas emissions and thereby slow the rate of global warming. It did not focus on policy options for developing and deploying sustainable energy technologies, nor on the relationship between energy alternatives and economic development. It did not address the need to consider climate change adaptation and mitigation strategies in an integrated way—for example, looking at how climate change might affect wind resources, the availability of water resources for hydropower, agricultural resources for the production of biofuels, and the demand for energy for buildings and industry.

In my judgment, a revitalized National Assessment process should be expanded to incorporate the full range of adaptation and mitigation issues. The Federal Government should commission a new nationwide, regionally- and sectorally-based assessment of technologies and strategies for mitigating global warming. This component of the assessment should include, for example, energy policy experts, renewable energy and energy efficiency companies, state energy offices, electric utilities, electricity regulators, and so on, somewhat analogous to the network established for the original National Assessment of climate change impacts.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUYE TO DR. F. SHERWOOD ROWLAND

Question 1. The overall levels of methane in the atmosphere, while at record levels, have stabilized over the past few years. Why do you believe this is happening and what, if any, are the policy implications of this stabilization?

Answer. The standing amount of methane in Earth's atmosphere depends upon the rates of emission of a dozen or more source types (swamps, cattle, termites, mining, natural gas leaks) and upon the actual removal processes from the atmosphere. The removal occurs almost entirely by one chemical reaction, the attack by hydroxyl (HO) radicals, and is reasonably well established and measured. However, the sources are geographically widely distributed and seldom intensively studied on a global basis (*e.g.* what are the amounts of methane released from Ugandan cattle.) Some of the sources such as emissions from rice paddies are affected by changes in agricultural practice whose effects on methane emission have not been well documented—rice paddies are numerous, vary much from one another in different locations, and are being judged by relatively few experiments. The only process which

I know to reducing emissions are the efforts to close methane leaks from the oil and gas industry, and these efforts are in general not fully documented.

Methane is in a different timeline category than most of the other greenhouse gases because its atmospheric lifetime is decadal in nature—about 8 years—in contrast to the century long time scale of carbon dioxide, nitrous oxide and the chlorofluorocarbons, on the one hand, and the monthly scale of tropospheric ozone and aerosols such as black carbon. Basically, the 1 percent growth rate in methane during the 1980s represented emissions equal to about 13 percent of the total amount present, and 12 percent loss of that present—net change +1 percent. The slow-down recently suggests that presently the emissions are now only about 12 percent of the amount present, for a net balance of no change.

This suggests two aspects—first, the change in global methane concentration which has taken place has been in part spontaneous rather than from deliberate actions, and second, that, for example, a concentrated effort on finding and fixing leaks in the existing global oil and natural gas delivery system might well tighten up the system enough to drive the global methane concentration downward, and ease somewhat the total greenhouse gas strain on the environment. The scattered reports which I have read where such leaks have been sought and fixed indicates that—because the leaking material is largely a commercial fuel which could otherwise be sold—that the costs for rigorous attention to the reduction of leakage may not have large associated net costs.

Question 2. What kinds of deposits of methane is it feasible to trap or cap?

Answer. My impression is that trapping and capping is very closely associated with the concentration of methane gas—that is, the ratio of the amount of methane relative to the amount of air mixed with it is the key to the cost and thereby the feasibility of trapping. The separation of methane from air has a cost associated with it which is generally dependent on how much air there is, rather than how much methane. The obvious first choice is closing the leaks of methane in the delivery system, not yet mixed with air. On the other end, capping of rice paddy emissions or the bubbles coming up from the melting Siberian tundra represent conditions which are far less favorable for collection of the purified methane.

Question 3. Politicizing the scientific process may make funding agencies hesitant to support controversial science. Also, young scientists may be unwilling to gamble their careers on an area of research where their funding could be under fire from political forces. What are your views on whether the funding agencies and newly minted Ph.D.s are more or less wary of working in certain controversial areas of science?

Answer. My own career experience began with roughly two decades of working with radioactive materials under circumstances in which the only disagreements were internal within the scientific conclusions to be drawn from certain experiments, that is with almost no public contact. From this situation, the CFC/ozone depletion hypothesis dropped into the middle of deep public controversy. The political controversy in this case was basically not between national political parties but between orientations toward the environment or toward industry. In the 1970s and 1980s, there were strong supporters on both sides from both the Republican and Democratic parties, in approximately equal numbers. The funding agency which was supporting my research in 1973 was the U.S. Atomic Energy Commission, which had been supporting my radiochemical research in a long, continuing series of one-year contracts for 17 years. This support continued through the transition into public controversy, as well as through the transformation of the AEC into ERDA and then DOE, and eventually ended in 1994. By this time, the larger part of research support for my work was coming from NASA, most of it for aircraft-based atmospheric experiments in a form quite different from our original laboratory-based experiments.

The most obvious changes in the "CFC/ozone controversial" period, (which lasted approximately 14 years until the adoption of the Montreal Protocol in 1987 and the NASA Ozone Trends Panel report early in 1988) were the drying up of invitations to give seminars to U.S. chemistry departments (but an increase to other departments) and applications for postdoctoral positions from U.S. students. Applications for postdoctoral positions from Asian and European universities continued as before, especially from Japan.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. TED STEVENS TO THOMAS R. KNUTSON

Question 1. From what I understand, you are one of the only scientists that has alleged censoring from NOAA. Considering that the agency sends out over 10,300 reports, press releases, and press contacts annually, do you believe that there is truly a systemic problem at the agency?

Answer. The problem is more serious than implied in the question. At the hearing. I focused on my own experiences, with a few anecdotal comments about the experiences of others at GFDL. Being an active researcher, I have little time to explore/document the pervasiveness of these problems at NOAA in detail. However, a recent report by the Government Accountability Project has researched this question in some detail. The full report can be downloaded from this site:

http://www.whistleblower.org/doc/2007/Final%203.28%20Redacting%20Climate%20science%20Report.pdf

Based on this report, it seems clear that the interference that government climate scientists at NOAA and other agencies have experienced in their interactions with the media is not just confined to a few isolated incidents involving a few scientists. Rather, there have clearly been more numerous incidents than should be tolerated at any agency, in my opinion.

The 10,300 NOAA reports and contacts annually is not a very appropriate statistic in the context of the problems being discussed, which are focused on the much smaller set of reports and individuals involved with leading-edge global warming research. For example, former GFDL directory Jerry Mahlman is quoted in the GAP report as follows:

> "NOAA employs roughly 1.200 people, the large majority of which have little or nothing to do with climate, or climate change. I think it is fair to say that there are about 120 people who are connected with the climate problem in some form other another. . . . Of that roughly 120 people, I would estimate that about, say, 20 of them are the ones who are actively submitting climate-warming relevant scientific papers to prestigious scientific journals . . ."

The NOAA incidents outlined in the GAP report typically involve some of these scientists (who are relatively rare within NOAA) that are publishing leading climate warming-relevant research in such journals.

In my opinion, NOAA should take pride in the accomplishments of its climate scientists within the ranks of the organization, and should encourage their interactions with the media. Instead the incidents outlined in the GAP report reveal an organization where a number of these scientists have at times had to try to overcome various hurdles from NOAA public affairs, and elsewhere in the government, in trying to convey their science to the general public. Since their research is funded by the U.S. tax payers, it seems appropriate to me that the tax payers should be entitled to learn about the results of the research that they are paying for, without interference from NOAA public affairs or other parts of the Federal Government.

Question 2. I understand that the recent Intergovernmental Panel on Climate Change report concludes that much of the warming over the past 50 years is caused by humans. I am concerned about human-caused factors. However, I am also interested in the effects of natural causes such as solar flares and the impact of the Pacific and Atlantic decadal oscillations. Do you feel enough has been done to examine the impacts of natural factors on climate change?

Answer. This is a very interesting question. My colleague Tom Delworth and I published an article in the journal *Science* several years ago examining possible causes for warming during the 20th century, focusing especially on the early 20th century warming. Here is a link to the article: *http://www.gfdl noaa.gov/reference/bibliography/2000/td0002.pdf*

Our analysis suggests that natural internal climate variability played a prominent role in the early 20th century warming, perhaps comparable to that of increasing greenhouse gases. In particular the strong warm event that occurred in the high latitudes of the northern hemisphere around the 1940s seemed to fit best with an explanation of a strong role (in that region) for internal climate variability. In the high northern latitudes, particularly around the North Atlantic, temperatures actually cooled from the 1940s to the 1970s. Based on this analysis, there does seem to be a role for internal climate variability in explaining some of the multi-decadal temperature variations during the 20th century. In fact, our climate model produced fairly realistic examples of such variations.

However, there is little evidence that natural internal variability has caused the global scale warming that has taken place from the late 1800s to the present. This warming has a much different spatial pattern than the multi-decadal variation that

took place in high northern latitudes in the early 20th century. The broad-scale long-time scale global warming has no "naturally occurring" analog in our climate model simulations. However, it is rather well-reproduced in our model if we force the model using best estimates of the changes in greenhouse gases and aerosols since the late 1800s.

Our view is that high northern latitude regions are characterized by a greater degree of natural multi-decadal climate variability than elsewhere on the globe. This can complicate the detection of the greenhouse warming signal in those regions. For example, is the more rapid warming in recent years in high northern latitudes an example of polar amplification of the greenhouse warming signal? Or is it another manifestation of internal climate variability, perhaps combined with a more modest greenhouse warming signal? The short answer is that we don't know at this time. However, we can say with a high degree of confidence that the *global* warming signal is not solely natural in origin, but rather that a large part of the global warming has been caused by increases in greenhouse gases from human activity.

Is enough being done to understand the role of natural factors? I think there is room for expanded research efforts on this topic (in fact on both natural and human-caused climate change). However, I don't believe that the *relative* degree of effort being expended on understanding these two topics (natural vs. human-caused climate change) is seriously out of line at this time.

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