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NASA AND EDUCATION

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SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

JUNE 19, 2002

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ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

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NASA AND EDUCATION

WEDNESDAY, JUNE 19, 2002

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

The Subcommittee met, pursuant to notice, at 2:40 p.m. in room SR–253, Russell Senate Office Building, Hon. Ron Wyden, Chairman of the Subcommittee, presiding.

OPENING STATEMENT OF HON. RON WYDEN, U.S. SENATOR FROM OREGON

Senator WYDEN. The Subcommittee on Science, Technology, and Space will come to order. Since last fall, the Subcommittee has spent considerable time discussing ways to mobilize a new generation of science and technology experts. The National Aeronautics and Space Administration has an important role to play in this endeavor through the promotion of scientific research, exploration, and education programs.

Mobilizing a new generation of science and technology experts is a growing challenge in the face of a shrinking number of Americans with degrees in science and engineering, but even more appalling is the lack of women in the professional ranks of these key fields. Of the 2 million scientists and engineers working in the United States, 90 percent are men. According to the Bureau of Labor Statistics, 93 percent of the country's aerospace engineers are men. The most recent statistics about college graduates reveal that out of 205 thousand graduates with degrees in math and the hard sciences, only 70,000 are women. So not only are fewer women studying math and the hard sciences, but even fewer are going on to careers in these fields. A positive note is the women who do pursue these careers on average earn more than women in other professional fields. The Bureau of Labor Statistics reports that women working as engineers, computer scientists, pharmacists, and lawyers have the highest median earnings of women in any professional occupation.

Now, some might argue that women do not pursue careers in the sciences because they are just uninterested, and that there are biological reasons why women do not go into math and science. The evidence, however, disputes those arguments. Studies indicate that girls show as much or more interest in math and science as boys in elementary school, but something happens around junior high school that seems to turn the girls away.

Some of this may be due to peer pressure. Kids may think math and science are just not cool. Some of it is due to teaching methods that may dissuade girls from math and science studies. Whatever the reasons, it is time for action that fosters, not frustrates, girls' interest in math and science and encourages them to pursue these important careers. The bias against women pursuing careers in math and the hard sciences can be found elsewhere in our society. The space program alone cannot root out this problem, but NASA, with the launch of its major new education initiative, can use this program as a trampoline that can land more women in these key academic disciplines from which they can find rewarding careers in a host of professions.

If NASA will use its new initiative to generate a significant increase in the number of women pursuing these careers, the benefits will be felt across our society, but today I want to issue a challenge to NASA. I would like the agency to help triple the number of women graduating from college with degrees in science, math, and engineering by the year 2012. Over the same decade, I want to see the overall number of graduates in math and the hard sciences triple as well.

This country needs to grow the next generation of innovators, engineers, astronauts and astrophysicists, and to energize more women to pursue these careers. This panel convenes today to look at NASA's efforts to do so. By educating and mobilizing the next generation for achievements in science and technology, NASA is working to deepen its roots in research and reach for new stratospheres in science. Whether pursued by men or women, science and math education are critically important. Simply put, technological advantages are also military and homeland security advantages. If America does not invest in science education, these advantages are going to be lost.

But science education and innovation are not the only components of national security. Scientific innovation has driven this country's economic competitiveness. Better engineering discoveries and the development of the Internet all contributed to the exponential growth of the economy in the last decade.

Today's witnesses are going to illustrate NASA's educational scope from the first grade to Ph.D. programs around the Nation. They are living examples of how NASA is developing educational material, teaching teachers, and funding education. These witnesses are both inspired and inspiring. Today's testimony will range a bit outside the realm of what one usually hears in these congressional hearing rooms. The Subcommittee is going to have an unusual opportunity to hear taped testimony from an astronaut working at the International Space Station, as well as to witness a live experiment by two promising young scientists.

We are very pleased to have the Administrator, Sean O'Keefe, here. He has made education a priority for NASA. He has done so not only because education is a worthwhile pursuit in itself, but also because he understands that education is vital to the future of his agency. One third of NASA's workforce is going to be eligible for retirement in the next 3 to 5 years. Today's undergraduate and graduate students, and even elementary students, can rest assured that their work and study is going to be sought after.

So the goals for today's hearing are threefold. First, to help pursue initiatives that encourage women to enter scientific and mathematical fields. Second, to examine NASA's current educational efforts, and third, to determine how they can best be expanded to benefit science and technology in general, and women in these critical disciplines specifically. This, in my view, is in the interest of the agency. It is in our interest to develop the talent and skills we are going to need to drive our economy, and obviously these skills will play a key role in national security. This was something that former House Speaker Newt Gingrich testified on when he recently appeared before this panel.

So we are excited today to welcome Administrator O'Keefe as well as Astronaut James Voss. Astronaut Peggy Whitson will testify via downlink from the International Space Station. An earthbound witness panel will include Peggy Steffen, the Albert Einstein Distinguished Educator Fellow from Ottumwa High School in Ottumwa, Iowa, Marci Whittaker, a nuclear engineer major at Oregon State University, and Brendan Dwyer and Christopher Broere, students from Ocean Avenue School in Northport, New York. We are very pleased to have all of our witnesses here, but first I want to recognize my colleague from Kansas, who has had a long interest in science policy on a variety of issues. I have enjoyed very much working with him, and I welcome his statement.

STATEMENT OF HON. SAM BROWNBACK,
U.S. SENATOR FROM KANSAS

Senator BROWNBACK. Thank you, Mr. Chairman. I appreciate that, and welcome to our panel, welcome to the people that are present here. It is going to be an exciting hearing, and it is an interesting discussion and an important issue that we are taking up. I want to thank particularly Administrator O'Keefe for his focus and his efforts that he has put forward to date.

Since its inception, NASA has had many different goals, from getting off the launch pad, to landing a man on the moon, to most recently establishing a permanent presence in space aboard the International Space Station. Behind each of these significant achievements are thousands of scientists, mathematicians, and engineers who labored long and hard to see their projects succeed in what is now a source of national and international accomplishment.

However, in light of the past successes, NASA is not immune to difficulties, as we know, and one of the difficulties facing us today is getting students interested in education fields in science and math. I find it disheartening that America is faced with this type of a problem. I hope that working together we can strive with success to get students involved in these fields.

You know, capturing the imagination and spirit of grade school students is the first step to ensuring the longevity of the technical field. Capturing that vision, providing students with the knowledge and ideas that keep NASA alive is imperative to the future success of the agency. It is certainly my hope that students will find a goal, embrace it, and grow from it. To do this we must give them something to get excited about, which is one of the key roles that NASA can play, and to me, that is what is one of the very exciting things

about NASA as an agency. It is one of those places that is always looking forward. Where is it that we are penetrated to? Where is it we are trying to go to? NASA can provide that vision so that the people can thrive, and they can survive and grow into that.

In my home State of Kansas, there is a wonderful organization of educators who spend their careers inspiring youth through education about the space program. The Kansas Cosmosphere and Space Center, which I hope the Administrator will come to sometime, is the first affiliation of the National Air & Space Museum and has a program called the Future Astronaut Training Program.

The program is essentially a space camp in which 11 to 15-year-old students spend a week training, living, and acting like astronauts. The week ends with a simulated shuttle flight mission, complete with a pinning of astronaut wings upon landing. The excitement that many of the students feel at camp keeps them coming back for the second and third levels of the camp, which includes weightless training in a scuba tank and a trip to the Johnson Space Center.

I might also add that one of my staff members now, Maggie Nelson, is a graduate of that program and works on NASA issues in my office, so I would call her a cadet graduate of the space camp in Kansas, and one that keeps her enthusiasm and focus going on this very important program.

As NASA takes more serious and deliberate steps towards education, I encourage you to embrace the successes of the past. Students at all levels need to be inspired and captured by what NASA is accomplishing. I commend you, Administrator O'Keefe, on your efforts and visionary goals. I hope that we will one day see some of the youth of today on a manned mission to Mars.

Again, thanks for holding the hearing. Thank you, Mr. Chairman, for doing this, and I think as we look to the future of NASA this is one of the most important things that we can try to push forward.

Senator WYDEN. Well, thank you, Senator Brownback. You and I have worked on a lot of initiatives over the years, and I look forward to pursuing this one with you.

Well, I think Administrator O'Keefe has some exciting news for us, so let us go to that news and your testimony.

STATEMENT OF HON. SEAN O'KEEFE, ADMINISTRATOR, NASA

Mr. O'KEEFE. Thank you, Mr. Chairman. The Space Shuttle Endeavor landed 20 minutes ago at Edwards Air Force Base. Everybody is fine, and there are certainly three members of that crew, Carl Walz, Dan Bursch, and Yuri Onifrienko, the commander of the expedition who are delighted to be back after their 6½ month stay, which now exceeds and is the new record for the longest duration of any American in space of 196 days.

Senator WYDEN. Our congratulations to them and to you.

Mr. O'KEEFE. Thank you, sir. We appreciate it very much.

Mr. Chairman, Senator Brownback, thank you very much for your willingness to conduct such a hearing. This is an initiative that we have just begun to really place great emphasis to and an opportunity showcase that a little bit, and we are grateful to you for your willingness to let us explore that a bit with you and to

gain some thought from you as well in terms of how we can expand it and make it even more robust.

One other tidbit of information I wanted to mention very quickly is, we have 20 members of the Goddard Academy here who are undergraduate students from around the country who are participating in study and research during the course of this summer at NASA's Goddard Space Flight Center, and their NASA mentor, David Rossage is here with them as well.

Senator WYDEN. Can we have them stand now so we can see all of them? Welcome to all of you.

[Applause.]

Mr. O'KEEFE. They will all be receiving applications as they leave at the end of the summer in our continuing quest to inspire the next generation, that is for sure.

First and foremost, in our efforts to narrow and be very specific about our focus at NASA, our mission objectives now include three. We have focused our attention to three primary focus areas. It is to understand and protect our home planet, to explore the universe, and to inspire that next generation of explorers, and this third area is the focus and the attention of the education initiatives that we seek to accomplish that task of inspiring the next generation of explorers for reasons, Mr. Chairman and Senator Brownback, that you have summarized very, very well in your opening statements.

It is imperative that the next generation be motivated and considered as the opportunities for the continuation and the quest of exploration and discovery in math, science, technology, and engineering as pursuits in disciplines within their college pursuits as well, so as a consequence we seek very specifically to extend our outreach effort to concentrate this as a core mission area, to think very directly about how we affect the education opportunities that will not only, I think, contribute to NASA's interest, as you summarize, Mr. Chairman, given the talent pool that we will see and really diminish over the course of this decade, and as a consequence the opportunity to educate and inspire that next generation to assume those opportunities in the future, but also I think it is a larger national contribution in a way, in the aerospace community at large, as a chance to, I think correct some of the imbalances that are two-sided, Mr. Chairman, as well as to continue this ever-focused effort.

We are about to explore the universe and to understand and protect our home planet as the other two objectives. In doing so, what we are attempting to do is to focus on this core mission area, to organize ourselves more directly to accomplish and to focus on an education outreach effort. Right now, there are just an incredible number of programs that we do throughout NASA at all 10 of our centers, at colleges and universities around the country, at grade schools and high schools around the Nation as well, and all of them are focused on a series of different objectives. Each of them are tremendous in their own right, but an effort that is not terribly coordinated in that context, and so as a consequence our first effort has been to think in organizational terms of how do we specifically organize ourselves to really leverage and multiply the opportunities we have in a range of cases to meet the kind of bold objectives that you cited and challenged us with, Mr. Chairman, in your opening

statement, and to be able to accomplish those kinds of tasks requires a little more organization focus.

In that regard, one of our leading experts on the staff at NASA, Paul Pastorek, who has been the president of the State Board of Education for the State of Louisiana for a number of years, prior to joining us at NASA just a few months ago is coordinating that effort and pulling together the activities in order to form that organizational focus we need in order to inspire the next generation of explorers.

The second area is to look at the tools and resources necessary to aid educators and, indeed, today we have an opportunity here from an educator who is involved and has gained a lot of experience in dealing with the range of resources and capabilities we have throughout NASA, and we hope to do that even more coordinated in a more concentrated way in the future.

In addition, we are also looking in the minority communities. We have a very vigorous historically black colleges and universities (HBCU) as well as Hispanic institution programs for research centers and a range of different activities for scholarships, fellowships, and grants, but nonetheless, what I have seen over the course of the last 6 months in my capacity as Administrator is an absence of our clear objectives thereafter to then recruit the folks who are the direct consequence of the efforts we have placed at HBCU's and Hispanic institutions as well, so we seek to really put a direct linkage to those kinds of programs that have been active, have been robust, but indeed need more attention in order to assure that on the recruiting side of the equation we are able to bring them to the aerospace community at large, or to the NASA family very specifically.

Fourth, we are looking to focus our attention very directly in a way that complements and that takes advantage of other Federal agency activity in this area. The President's initiatives on math and science partnership arrangements, as well as the very specific efforts the Congress engaged in to enact the no-child-left-behind legislation last year is a rare opportunity to really participate in what has become a very vibrant effort at the Department of Education in order to establish outreach programs that are more coordinated, more focused, and more attentive to what we see as the education needs across the board. So as a consequence we are working hand-in-glove with the Department of Education, following their lead in terms of the outreach efforts, and with the National Science Foundation, very specifically to think in terms of how we will organize our efforts across the board.

And finally to add a signature effort to this, to really gain the excitement necessary to motivate the interest that we will see there, and to utilize the capacity that we have invested in so extensively over the course of the last decades. We have sought to establish an educator mission specialist series, and fully trained astronaut program element which will seek to recruit teachers, educators to the task of qualifying as astronauts and participating in the full range of activities on any mission, to include the kinds of missions we saw just successfully completed here moments ago.

So our very first educator mission specialist, Barbara Morgan, will be slated for flight in 2004. She is in the advanced candidate

program right now, has completed all the efforts in order to be fully qualified in that regard, and will now begin training in the months ahead for her specific mission objectives, and today I think we have an opportunity to hear from Jim Voss, who will explain what that range of opportunities are that can be gained from the International Space Station in a way that uniquely teachers and educators can view that capacity as a way to transmit and provide greater insight to the exploration and discovery objectives.

Jim having served as a crew member on the expedition 2, the second mission of extended duration on International Space Station, he has now fully recovered, so he is empathizing with his three colleagues who have just now returned, and understands exactly what they have gone through. I think it will give us some insight in terms of how extensive that capacity may be utilized.

And I think today, in conclusion, Mr. Chairman, we also have a rare opportunity to meet a couple of the next generation we really seek to motivate. Both Christopher and Brandon are folks that we intend to be sure they leave with applications dated in the year 2012, so that we can be the first to motivate them to join the NASA family as soon as they complete their studies after college, and I think they will give us a hint today of their interest and zeal for the science and engineering professions as well.

Again, thank you, Mr. Chairman, for your willingness to host this hearing and the opportunity to explore this question and to gain some thoughts and ideas from you and Senator Brownback in terms of how we may improve this even further.

[The prepared statement of Mr. O'Keefe follows:]

PREPARED STATEMENT OF HON. SEAN O'KEEFE, ADMINISTRATOR, NASA

I appreciate the opportunity to appear before the Subcommittee today to share with you the vision and mission of the NASA Education Program. Since becoming Administrator, it has been my fortune to meet some of the most innovative and imaginative people our Nation has ever produced. The men and women of NASA do remarkable things every day. From designing, constructing and operating an orbiting laboratory traveling at over 17,000 miles an hour, two hundred and fifty miles above the Earth, to designing new systems and technologies that enable our aircraft to fly faster and safer, these revolutions of engineering and American know-how are testament to this Agency's ability to transform our way of life in countless and unimagined ways. As we all know, NASA's past is legendary but its future is full of even greater promise. Our mission in this endeavor is Education and our charge as directed by our new Mission Statement is *to inspire the next generation of explorers . . . as only NASA can*.

With a charter like no other, NASA has led some of the most unique missions in the world. From traveling to low-Earth orbit and walking on the Moon, to viewing the farthest reaches of our solar system, NASA has continually worked to share the discovery and adventure along the way. Each of these achievements are things that only NASA can do and as such, it is this Agency's responsibility to be sure that those experiences are shared with inquisitive minds who want to go even further. For those minds to be ready for the future challenges that await them, we as an Agency must do everything we can to inspire and prepare them.

Every mission we accept requires the sharpest of minds, the strength of purpose and the drive to challenge barriers and frontiers. The minds we seek to develop will do those things and more for NASA, but more importantly, they will do these things for our Nation as well. NASA not only needs a future with more engineers and scientists, but our Nation does as well. Our current and future missions are dependent upon such minds and it is our charge to help our Nation prepare them for the challenges ahead. As the Hart-Rudman Commission found, "Second only to a weapon of mass destruction detonating in an American city, we can think of nothing more

dangerous than a failure to manage properly science, technology, and education for the common good over the next century."

The Commission's Report further declared that, "The harsh fact is that theU.S.need for the highest quality human capital in science, mathematics, and engineering is not being met."

Failure is not an option in this endeavor. NASA's future missions, as well as our national and economic security, are dependent upon our success. The human capital proposals contained in title II of our proposed NASA authorization bill for fiscal year 2003 which we submitted to the Congress on May 29 are intended to address some of these challenges. These legislative tools are consistent with government-wide provisions contained in the President's Managerial Flexibility Act. It is imperative to pursue enactment of these vital tools for NASA to help meet our recruiting and retention of human capital. Together with the National Aeronautics and Space Administration Science and Technology Career Enhancement Act previously submitted to Congress on July 20, 2001, this legislation will give NASA significant tools with which to improve the pipeline of science and engineering talent for our Nation's workforce.

I look forward to working with the Committee on this legislation.

Complementing these efforts is NASA's FY03 request for Academic Programs. The Agency's $143.7M request has two components—base funding for the Education Program and the Minority University Research and Education Program:

1) The Education Program request is for $61.6M. This request provides funding for a comprehensive program that includes: $11.3M for student support, $9.2M for teacher/faculty preparation and enhancement programs, $30.4 for state-based support of education, $9.1M for educational technology, and $1.6M for evaluation.

2) The Minority University Research and Education Program request is $82.1M. This request provides funding for Historically Black Colleges and Universities ($49.7M) and Other Minority Universities ($32.4).

These future investments, combined with the Congress' and Administration's previous support have built a remarkable foundation for the Agency's education programs. This foundation though is in need of expansion. Not by the addition of more dollars, but rather through closer coordination within the Agency's internal operations as well as with our education partners, the U.S. Department of Education as well as other public and private sector stakeholders. I look forward to working with the Committee on these and other efforts that impact America's space and aeronautics program.

With these thoughts in mind, there are five key points covered in this testimony:

1) NASA has made Education a core mission of the Agency;

2) NASA accepts the responsibility of inspiring the next generation of explorers;

3) NASA is reaching out to minority communities to make them integral partners in the Agency's mission;

4) NASA will work with other federal, state and local governments, as well as industry members, educational organizations and public stakeholders to ensure mission success; and,

5) NASA's Education initiatives will reach more American students than before.

With its network of NASA Centers and educational partners across the Nation, NASA is moving forward in each of these five areas. The President has issued a call to all Americans that there be *no child left behind* when it comes to Education. NASA has accepted its responsibility in that charge, and as one of the Nation's stewards in developing new technologies and opening new frontiers in air, space and innovation, we are prepared to share the promise and discovery of tomorrow's future.

1) NASA has made Education a core mission of the Agency.

Upon becoming Administrator, I was personally moved by my interactions with young people, at our Centers as well as in my own family, and the connection and inspiration that they feel to America's space program. Young people are full of wonder and discovery and NASA has a responsibility to help those traits mature. As we seek to improve our life here, and extend life beyond our known universe, we must work to inspire our children to explore the great frontiers of our solar system and conquer the challenges of propulsion, human biology and technology that keep us close to our home planet. That means we have to help our students understand how mathematics, science, engineering and technology come together to make explo-

ration and innovation possible. Too many students avoid these subjects because they are seen as unpopular, not relevant to their daily lives, or too difficult. These very subject areas though are the fundamental baseline of NASA mission success. Without them, Space Shuttles do not fly, Space Stations are not built, aircraft are not tested and universes go undiscovered. We will not be able to explore without them.

Since its inception more than forty years ago, NASA has worked to share its findings and missions with the educators and the students who wanted to know more about the world and universe that surrounds them. The resulting programs and initiatives have targeted our Nation's K–12 students as well as our undergraduate, graduate and doctoral students. Today the Agency is served by many of the alumni of these efforts who work in various capacities at NASA Centers, universities, affiliated research organizations or in industry. The challenge before us today though is to extend the reach of our education efforts even further. Currently, NASA's education programs are distributed throughout our ten Field Centers, our five strategic Enterprises, as well as two Agency-wide functional offices. These efforts have been highly productive and have produced numerous success stories in students and classrooms across the country. But a more coordinated management approach will further enhance our reach and enable our performance level to reach new heights.

Recently, an internal Agency Task Force was formed to examine the Agency's current education mechanisms, its best practices, and ways that could merge existing efforts into a more cohesive and coordinated approach. The Task Force members will discuss with our educational stakeholders, particularly in the minority communities, those means that would help us reach more students and inspire them to pursue futures in mathematics, science and engineering.

The findings and recommendations from the Task Force are to be reported to me shortly. It is my hope that upon receipt of their final report, a new and re-energized NASA Education Program will be formed to enhance the success of an already impressive history by NASA in the education area.

Once a new educational organization has been established, we will examine the unique tools and experiences that we provide to our Nation's educators. If we are to expect our teachers and professors to build the workforce of the future, we must provide the tools and experiences that can best help them participate in the missions and discoveries that NASA has made possible.

Extending our reach to underserved and underrepresented communities is critically important to me and to NASA. Our missions are meant to serve the interests of humanity and that means building a mission-oriented team that represents the best and brightest of America. The challenge before NASA as well as our Nation is reaching out to those communities that have traditionally not been a part of such a mission and opening the door of opportunity to invite them to take part. NASA's Kennedy Space Center and the State of Florida opened such a door this past year.

In a program inspired by Florida's First Lady, Columba Bush, Kennedy Space Center, in partnership with the Florida Department of Education, created the Student Educational Experience (SEE)—NASA Program. The SEE–NASA Program targets 5th grade students in Florida in schools that are underperforming in science and mathematics in an effort to help answer the question, "why do I need to study science and math?" By exposing these students to "hands-on" activities that relate to real-world circumstances as well as NASA missions, this program seeks to inspire these students to achieve things that they may never have considered before. While the SEE–NASA Program's goal is to inspire its students to further their study of mathematics, science and technology, it also works with these students' teachers to prepare them before the actual program begins, as well as following the program's conclusion. By providing these teachers with the "tools" to keep their students inspired and interested in mathematics and science long after they have left the Kennedy Space Center, a new door of opportunity for a new generation of explorers is opened. This door would not have opened though without the help of the Florida Department of Education and many other Florida education stakeholders.

This partnership between NASA and the State of Florida is not unique. NASA will continue to work with Secretary Paige and the U.S. Department of Education in all 50 states and with their respective education departments to understand not just the internal infrastructures of reaching teachers and students, but to understand each of the state's educational standards as well. With the increased attention our Nation is giving to student achievement, NASA too is paying attention to this national trend. Our states and our teachers are at the forefront of the education challenge and as such, NASA's education program is making every effort to listen and understand what their needs are and how we can assist them in ways that only NASA can. By providing them the "tools," experiences and, where possible, training, NASA can better help these educators serve our communities and our children.

Such services to educators and students are not limited to those areas that reside near a NASA Field Center. NASA is working to ensure that every region of our country is reached. NASA's Aerospace Education Service Program (AESP) served over 1,500 schools during the 2001–2002 school year. This included 1,207 workshops for 14,093 teachers; 2,817 programs presented for 186,440 students; and visited 2,249 classrooms touching 44,584 students. Located in all 50 states, the AESP enables NASA to send an expertly trained education specialist to visit school districts and provide training to teachers in mathematics, science, technology and geography instruction. By showing them real-NASA applications that can be taken back into the classroom, NASA helps these teachers to turn more students' minds toward the direction of mathematics, science and engineering.

In addition to AESP, NASA is also working with our Nation's museums and science centers to better educate the public about the universe, our role in it and the discoveries that NASA researchers and their partners are making. Recently NASA signed a Memorandum of Understanding (MOU) with six of the Nation's premier science centers/museums and the Association of Science and Technology Centers. This MOU is designed to help NASA reach even more communities by providing increased access to our missions, educational programming, and unique NASA experiences. Explorers reside across our country and by sharing our experiences in a variety of settings, NASA can bring them to our greatest adventures.

The American Museum of Natural History's Rose Center for Earth and Space, located in downtown Manhattan, provides in-person and virtual/electronic programming to students, families and educators on the formation of our galaxy, the creation of stars and the expansion of our universe. In addition to opening their minds about the surrounding universe, the Museum's Earth Science Bulletin provides a virtual source of news breaking events that are occurring on our planet (i.e. volcanoes, hurricanes, earthquakes). By providing such real-time information and "educating" visitors about our planet, NASA and its Museum/Science Center partners are promoting better understanding of our Earth and our universe. The Rose Center was also the site of last week's presentation of the flags flown for the victims of the World Trade Center lost on September 11th.

The Agency also links inquisitive minds to its various missions through the power of the Internet. NASA's presence on the World Wide Web has provided millions of students with the information they have wanted to know about the planets, our astronauts, and our on-going exploration of the universe. By giving students a "passenger seat" for the mission of their interest, the Agency looks to feed their curiosity and encourage them to study the disciplines that will take their knowledge, and NASA's further. NASA's efforts under the President's Management Agenda and its "E-Government" initiative are accelerating and expanding these opportunities and in the Fall of 2002, more educational programming directly linked to NASA's upcoming missions to the International Space Station and Mars exploration will be available on-line.

In addition to utilizing the Internet to connect students and educators to our missions, NASA also has an accomplished presence in television as well. This past Saturday, June 15, 2002, the NASA's CONNECT™ program, "Geometry and Algebra: The Future Flight Equation," received a regional Emmy award in the category "Children's Programming" in a competition sponsored by the Washington, D.C. Chapter of the National Academy of Television Arts and Sciences. This is the fifth Emmy the NASA CONNECT™ series has received and the eighth Emmy in the Agency's history. "Geometry and Algebra: The Future Flight Equation" focuses on experimental aircraft and the Hyper-X Research Vehicle. NASA CONNECT™ is a research and standards-based, award-winning series of mathematics-focused, instructional programs for students in grades 6–8. Each program in the series includes a 30-minute instructional broadcast, an educator guide, and an interactive web-based component. Programs in the series establish a connection between the mathematics, science, and technology concepts taught in the classroom to those used everyday by NASA researchers. The educator guide, containing a hands-on activity, and the web-based component reinforce and extend the objectives presented in the program. The NASA CONNECT™ program is broadcast nationally on Cable Access, ITV, and PBS-member stations.

While NASA's programming may be available in many of the Nation's classrooms, computers, museums and science centers and televisions, the Agency will continue to explore new avenues to help open the minds of more students to the promise that mathematics, science, engineering and technology pose for their future. With the addition of Educator Mission Specialists to NASA's astronaut corps, the Agency's educational horizons and capabilities will continue to expand. The launch of Barbara Morgan, following core completion of the International Space Station, will be our

first step in this new ambitious effort. Those that follow Barbara will build upon her success and take our Education mission to even greater heights.

2) NASA accepts the responsibility of inspiring the next generation of explorers.

Our Nation's educators hold one of the world's most influential and esteemed positions. They are molding the future of a country that has explored the world and its surrounding universe in ways and means once never imagined. Regardless of their age, the students that sit in today's classrooms will inherit a legacy marked by huge strides in technology and innovation. Our challenge at NASA is finding the men and women who will take these technologies and innovations to their next level. Our charge as a Nation and as an Agency is to do everything we can to prepare that next generation for that responsibility.

For years, NASA has offered unique opportunities for educators and students to participate in inspirational, "once in a lifetime" educational opportunities. Whether as students participating in a KC–135 parabolic flight experiment, constructing payloads and small launch vehicles as part of the National Student Involvement Program (NSIP), or by polishing mirrors for a satellite—and then tracking its orbit via computers and telescopes, each of these examples are all opportunities that NASA has uniquely enabled. The Agency recognizes its unequaled position and the responsibility that comes with it.

The Agency imperative for pursuing a renewed focus to education is immediate. At NASA's Marshall Space Flight Center in Huntsville, Alabama, 62 engineers out of the 3,000-person workforce are under 30 years old. Our over-60 population, across the Agency is three times larger than the under-30 workforce. Inspiring the next generation of explorers to enter fields of science and engineering is critical to NASA's success in reconstituting our workforce for the 21st Century challenges.

NASA is not alone in its search for enthusiastic and qualified human capital. Throughout the federal government, as well as the private sector, the challenge faced by a lack of scientists and engineers is real and is growing by the day. A recent Wall Street Journal article, dated June 7, 2002, chronicled the challenge faced by our Nation. The article written by Sharon Begley, entitled "*As We Lose Engineers, Who Will Take Us Into the Future*?" explained that, "Engineering bachelor's degrees peaked in 1985 at 77,572, and plunged to 60,914 in 1998. By the mid-1990s, more kids were getting degrees in 'parks and recreation' than in electrical engineering."

In sharp contrast, the demand for math, science and engineering disciplines is growing. The U.S. Department of Labor's Bureau of Labor Statistics echoes these trends. In their report, *Working in the 21st Century*, the Bureau states that seven of the ten fastest growing occupations require some application of mathematics and science.

In building a future workforce, our Nation must begin to understand the qualities and challenges that will be encountered in constructing it. That means preparing future workers with the skills necessary to compete.

In the State of Mississippi, they are working to build a future workforce to serve the emerging geospatial technology industry. These technologies comprise one of the fastest growing high technology sectors today, with expected growth to $21 billion by the year 2005. NASA's Earth Science Enterprise and the NASA John C. Stennis Space Center Office of Education are leading the National Workforce Development Education and Training Initiative. Representing a collaboration of organizations, the Initiative is based on the successful *Mississippi Model*, which is customer driven, utilizes existing infrastructures and is designed to create systemic change. As a result, all 7–9th grade students in Mississippi will learn about the applications of geospatial technologies and how they may become part of that workforce.

Our Nation's future is built upon the minds that accept the hard challenges that mathematics, engineering and science offer. That is why we at NASA through our current and future missions, as well as through our re-energized Education Program, will work with the Congress and our federal, state and local government, and other public and private sector educational partners to reverse this trend.

NASA's missions once inspired a generation to explore the stars and race for the Moon. While our missions and points of destination have changed, the same challenges remain very much a part of our future. We accept our responsibility to inspire a new generation of explorers and we will succeed in ways that only NASA can.

3) NASA is reaching out to minority communities to make them integral partners in the Agency's mission.

NASA's success is a result of the talented men and women who come together around a mission, form a team around that effort and work tirelessly and cooperatively for mission success. The results of these efforts are legendary but at NASA these results occur everyday in ways heralded in news headlines and in so many countless, anonymous ways. Regardless of the team's recognition, the formula has always been the same—empower talented people with a mission and resources to make something happen and let them go. Before that team can achieve success though, team members have to be built.

At Marshall Space Flight Center, the Student Launch Initiative (SLI) is helping to build those future NASA Team members. The SLI involves high school and college students in the design, building and testing of reusable rockets with associated scientific payloads. This unique, hands-on experience allows students to demonstrate proof-of-concept for their designs and gives previously abstract concepts tangibility. At the high school level, several schools compete to construct a vehicle designed to reach an altitude of one-mile. In addition to actual vehicle performance, schools are also evaluated on design and other criteria. Two local universities have recently completed the first year of the program with one institution constructing a vehicle that reached two miles and the other providing the payload. Future plans for the college level could include expansion of the program to a regional or statewide level.

While the SLI program is a good example of the Agency's efforts to develop future NASA team members in Alabama, the Agency is also aggressively exploring the expansion of its team in the Nation's minority communities. As the Bureau of Labor Statistics Report, "*Working in the 21st Century*," has chronicled, "minorities are the fastest growing part of the labor force." As such, NASA must do everything it can to further enhance their involvement in our existing efforts, as well as future missions. Such efforts must target multiple areas and NASA has already begun a strong foundation upon which to build.

Programs such as the Summer High School Apprenticeship Research Program (SHARP) provide over 450 students the opportunity to participate in an intensive science and engineering apprenticeship program at a NASA Center or affiliated research facility. These eight-week paid apprenticeships enable participating students during the summer months to participate in hands-on research with NASA mentors and become exposed to careers related to mathematics, science, engineering and technology. In 2001, 79 percent of the students participating in SHARP were from minority communities. Of the more than 5,000 students that have participated in SHARP, 90 percent have enrolled in college majoring in a math, science, engineering or technology discipline and 80 percent of SHARP's students are now working in math, science, engineering and technology related fields.

NASA plans to highlight our substantive programs to integrate underrepresented students into research and education opportunities and use the NASA mission to motivate and prepare today's students and educators to become tomorrow's scientists, mathematicians and engineers. These efforts come from our reaching out to Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), and Other Minority Universities (OMUs) to enhance their involvement in the Agency's mission.

Before many of these students enter these institutions though, an educational pipeline must be created that engages students in the earliest grades and motivates them to continue on through college, graduate school and postgraduate studies. By using NASA's educational resources—including scientific, technical and educational personnel—to strengthen pre-college programs, NASA assists students to be (1) fully prepared in college preparatory subjects when they enter college, (2) able to handle the rigorous academic level of college, and (3) motivated to continue to advanced degrees in mathematics and science disciplines. Through these early interventions in mathematics and science, we hope to achieve NASA's goal "to inspire the next generation of explorers" and increase the number of underrepresented students in that exploration. Pre-college programs, such as Science, Engineering, Mathematics, Aerospace Academy (SEMAA); Precollege Achievement of Excellence in Mathematics, Science, Engineering and Technology (PACE/MSET); Saturday Academies; TEXPREP; and Projecto ACCESS, provide hands on/minds on experiences that motivate and prepare students to pursue NASA-related careers.

NASA is also opening opportunities for minority institutions to contribute directly to improving our Nation's scientific literacy. Through broad-based, competitive, multidisciplinary research programs operated by undergraduate, graduate and faculty research programs and University Research Centers (URC), some major scientific research contributions have been made. Some examples include:

Tennessee State University Center for Automated Space Science observed the first direct detection of an extra-solar planet, marking the first time that properties of such a planet could be directly measured.

Tuskegee University Center for Food and Environmental Systems for Human Exploration of Space flew the sweet potato stem-cutting experiment on the Space Shuttle Columbia, mission STS–93, which flew in July 1999. This valuable research will contribute to our knowledge of the care and feeding of humans on long duration space flight.

The University of Puerto Rico at Mayaguez partnered with NASA's Goddard Space Flight Center in Maryland to establish a satellite receiving station for one-tenth of the typical cost for remote-sensing ground stations. This project was recognized as a model for academic institutions seeking low-cost remote-sensing receiving capabilities.

The NASA Center for Applied Radiation Research (CARR) at Prairie View A&M University is seeking ways to incorporate and optimize radiation tolerance of a human spacecraft by taking a systems approach to the spacecraft design. The research at Prairie View studies the effects associated with radiation interaction with materials, as well as radiation effects on electronics and radiation shielding. CARR's projects are linked to the expressed needs of NASA's Human Exploration and Development of Space Enterprise and the Aerospace Technology Enterprise.

For our country to be able to venture forward with future missions in aeronautics and space exploration, the participation of the minority community is critical to achieving mission success. It is the diversity of a team's membership, at NASA or any other organization that enables it to do the most amazing things. Our leadership in these areas has been good but there is still much we can do. As world history can attest, exploration opens many doors of opportunity and at NASA we will continue to open those doors everyday. With leaders and examples such as Mar's Program Director, Dr. Orlando Figueroa; the 2002 Black Engineer of the Year, Kennedy Space Center's Kelvin Manning and Olga Dominguez, our Agency's Chief Environmental Officer to guide us and our Nation's youth, the next generation of explorers will leave no child behind.

4) NASA will work with other federal, state and local governments, as well as industry members, educational organizations and public stakeholders to ensure mission success.

While there are missions and activities that only NASA can perform, it cannot complete its education in a vacuum. Partnerships and relationships with stakeholders in government, the private and public sector, both inside and outside of education must be engaged. Each of these constituencies has a vested interest in forming the human capital that can contribute to our Nation's future in mathematics, science and technology areas. NASA has begun discussions with the interagency team that is implementing the U.S. Department of Education's and National Science Foundation's (NSF) Math and Science Partnerships. The resulting dialogue between NASA, the Department of Education, NSF, and the other Initiative partners has revealed how we can complement each organization in developing interest and engagement in math, science and technology related careers by America's students.

The challenge before this partnership is a significant one. The recently issued report by the National Commission on Mathematics and Science Teaching in the 21st Century, *Before It's Too Late*, captured the urgency of this challenge when it declared that, "more than 240,000 new and qualified science and mathematics teachers are needed in our K–12 classrooms over the next decade (out of a total need for an estimated 2.2 million new teachers)."

Addressing such circumstances is a challenge that requires teamwork on the part of our National and state governments. NASA has accepted this challenge and helped form Texas Aerospace Scholars (TAS). As an outcome of a partnership created in 1999 among the NASA Johnson Space Center (JSC), the Texas State Legislature, schools, universities, and diverse community organizations like Rotary and the Houston Rodeo, TAS encourages students to consider careers in science and engineering. In the Middle School Aerospace Scholars program, teams of 8th grade teachers from across the state of Texas begin this year-long program with a one-week summer professional development experience at JSC, learning how to integrate distance learning programs (videoconference and webcast technology) into their classrooms during the school year. The Community College Aerospace Scholars (CAS) provides 300 community college students and 30 professors with web-based assignments and a two-day visit to JSC where students and professors interact with engineers and scientists. Finally, High School Aerospace Scholars, for high school

juniors, combines an interactive online learning experience along with a weeklong residential experience during the summer at JSC.

NASA's Space Grant Consortium is another example of partners working together to advance the mission of education. Located in all 50 states and Washington, D.C. and Puerto Rico, Space Grant links 512 of the Nation's colleges/universities, 73 businesses/industries, 36 State/Local governments and 165 other affiliates into a network that is advancing space and aeronautics related research. Over 3 million people have been served by this program while helping to build the next generation of leaders, researchers, innovators and explorers in space-related fields. NASA's $19.1M investment in FY2000 was leveraged with $55M in other funds from industry, academia and other government funding sources. This type of partnership distributes not just the responsibility for funding such an enterprise, but shares the participation and subsequent return on investment. When formed by Congress in 1989, it was never intended for NASA to be the sole beneficiary of Space Grant. Rather, it was the Nation who stood to benefit from developing increased research capabilities in our colleges and universities and a skilled workforce that could share its knowledge and experiences with industry, academia and NASA.

Each of the education partnerships I have highlighted are emblematic of the approach that NASA takes to all of its missions. Each partner and team member brings their expertise to the table and through dialogue, understanding and working together, goals are achieved and missions are completed. Our mission in education and in inspiring the next generation of explorers is one mission though that will never be complete, or one in which we will tire. Our future rests with each subsequent generation and each of us must do our part to prepare one another for a future of challenge, promise and unlimited possibility. NASA welcomes all partners in that endeavor and looks forward to working with each of them.

5) NASA's Education initiatives will reach more American students than before.

The programs and initiatives that I have presented to you in this submission represent a small but illustrative part of NASA's present education capabilities. While all are impressive and accomplished and have made a difference to lives of many people, there is still more that can be done by this Agency to reach out to more of our Nation's youth.

In a talk at Syracuse University two months ago, I outlined NASA's new vision and mission and announced the initiation of the Educator Mission Specialist Program as the signature piece of NASA's renewed commitment to education and teachers. The first EMS, Barbara Morgan, will soon be assigned to a Space Shuttle flight after completion of the International Space Station core configuration. The opportunity to inspire students, motivate teachers, and engage the public through Ms. Morgan and future Educator Mission Specialists, whose profession as teachers is to communicate scientific and technical concepts, will enable NASA to invigorate a resurgence in educational achievement in science, mathematics, engineering, and technology.

To fully realize our vision for the EMS program we have begun to outline the details of this initiative with the U.S. Department of Education, the National Science Foundation, and other education organizations. We will implement the EMS program in full consultation and collaboration with the educational community, to help ensure that the potential of this national asset is fully realized.

Not only will we involve professional educators in the implementation of the EMS program, we hope to involve students throughout the country in this process as well. We're planning to ask their opinions of what makes a good teacher of science, mathematics, or technology. We want to know what activities and investigations from this "classroom" in space will engage and inspire them. Most of all, we want to engage their participation and inspire the next generation of explorers.

By harnessing the awe-inspiring power of space exploration to the teaching experience, the EMS program and the other education activities I've described today will enable NASA to make an important contribution to the goals embodied in the landmark legislation that Congress enacted with the passage of the President's historic legislation that there be *No Child Left Behind*. The minds of America's young people need inspiring missions of exploration to challenge and motivate them to great achievements. Our nation's teachers need NASA's mission of discovery to serve as a teaching tool for powerful ideas. The EMS program will engage students and their teachers in new learning opportunities and promote interest and achievement in science, mathematics, and technology.

The future steps that we take—a new, more coordinated Office of Education to better serve our Nation's students and educators; the expansion of our Astronaut corps to include Educator Mission Specialists; increased utilization of the Internet

and information technologies to connect students, educators and the public at large to our missions here on Earth and beyond; as well as many more—are all steps that NASA takes in the great frontier of expanding human knowledge.

The vision for NASA is to improve our lives here on Earth, extend our lives to reaches far beyond our home, and find life beyond. Everyday that vision is being fulfilled at NASA. Barriers that once held us back are being broken and unexplored frontiers, once never imagined, have become our daily realm for operation. We accept this vision with vigor and boundless energy but that excitement comes with immense responsibility. The greatest mission this Agency has ever accepted is helping to open the mind of a child to unimagined possibilities.

The men and women of NASA are committed to ensuring those who follow us in the great missions of tomorrow are prepared to accept the challenges and circumstances that come with them. Our efforts in science, mathematics, engineering, and technology education, in partnership with many team members from throughout the Administration, the Congress, and the public and private sectors, will prepare those generations. It is a mission that we accept and a mission that we will not fail to accomplish. The next generation of explorers demands our success. It is an adventure that NASA welcomes.

[Response to Senator Allen's questions to Mr. O'Keefe follows:]

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. GEORGE ALLEN TO SEAN O'KEEFE

Question. The NASA Student Involvement Program provides a wonderful opportunity to interest students in space as well as promote science, math, and technology education. What are NASA's plans to improve and expand this program?

Answer. NASA is in the midst of focusing our Education Program to support Education as a core mission of the Agency: to inspire the next generation of explorers . . . as only NASA can.

The NASA Student Involvement Program (NSIP) is one of NASA's national programs that "inspires the next generation of explorers." As we strengthen our Education Programs to align with our new core mission, NSIP will continue to provide a valuable asset to this new emphasis.

Senator WYDEN. Thank you very much. That gets us off to an excellent start, and we will just go right to our additional panelists. Let me recognize Astronaut Colonel Jim Voss.

STATEMENT OF COLONEL JAMES S. VOSS, ASTRONAUT, NASA

Colonel VOSS. Thank you very much for the opportunity to come and talk to you today. In particular, I want to talk to you about the power of space flight to be used as an educational tool. We want to inspire the next generation of space explorers, and I truly believe that the assets we have in space can be used for that.

Last year, I spent 5½ months onboard the International Space Station, along with my crew mate, Susan Helms, and Yuri Usachev. We had the opportunity to interact with a large number of teachers and students and to conduct educational activities from the International Space Station. I know that our work with them both motivated and inspired them.

You know, we were just beginning the assembly of the Space Station last year. It was an extremely busy time. We were still having things that needed some help to make them go right. We were very busy. NASA thought so highly of our educational endeavors in space that they still scheduled numerous activities for us. We had over 20 different educational activities that were done during our 5½ months. That is about one every week that we were up there when we did not have a shuttle crew onboard. I think that shows a lot of commitment in the early phases of the Space Station program.

The Space Station is such a unique orbiting classroom. It is a laboratory, but it is also a classroom. You are able to demonstrate some things in space that you just cannot do down here. Newton's laws of motion work perfectly up there, and when you show them in space, people really can understand them completely. It is just a wonderful classroom, and we can teach a lot of things from there.

We had several specific experiments that were done during the expedition 2 to the International Space Station. One of them was called EarthKAM. That is the Earth knowledge acquired by middle school students, and what it is, is an electronic camera that is looking back at the Earth. It is attached to a computer. Students all around the country decided what they wanted to take pictures of, they input their selection into a process very similar to what we use for normal scientific research onboard the International Space Station, and then those pictures were taken automatically for them, returned to the ground, and then they used them in their research in the classroom. It is just a wonderful example of getting students involved in real world research in space.

We took 488 images that were used in the classroom that are now available for the public for other classrooms to use. I am extremely happy to have participated in that. It was very rewarding to me personally to be able to help those students with their research.

There is another educational program that has to do with our amateur radio on the International Space Station. This is a ham radio. It offers the opportunity for students to experience the excitement of talking directly to an astronaut in space and having their questions answered via this ham radio system. During the year and a half that we have had human beings onboard the International Space Station, we have had 65 contacts with classrooms in 26 States and in 10 different countries, and during that time, hundreds of students have asked questions of astronauts in orbit, and over 15,000 other students, their classmates, have listened to those answers. It is a way that really gets students involved and excited about space, science, and other things, and if you will bear with me, I would like to read something from a gentleman who was involved with one of these events.

It is from a Mr. Alan White, who is from Eufalla, Alabama, and he wrote me a note after my flight that said this. Did the contact with the ISS have educational benefits? Yes. That was his emphasis. Would we spend the time and preparation to do it again? Yes. There is no way I can adequately describe the excitement this created in our school and community. I think this was the most exciting educational event of the year for these students. Nearly 100 students submitted questions. All three of the science teachers at the Admiral Moore Middle School, the principal, and the school administrators supported the efforts in every way possible.

Interesting, the space studies unit was heightened. The U.S. space program and the International Space Station became real to both the students and the community because our kids actually talked directly to an astronaut in space. The space program was no longer just something they had read about. And I like this part. This event was the talk of the town for weeks. So not only did it get the kids involved, but the entire community. This is the typical

reaction that I heard here from the educational activities that we have participated in space.

There is another area that we also conducted educational activities, and that was the NASA space flight educational opportunities program. It is a NASA program that allows live interactive discussions with astronauts on orbit. It is conducted with our normal communications system, so it can be fairly long, and students ask questions and we answer them. We did some of these throughout the United States. Sioux City, Iowa, San Francisco, there was a design institute in New York, but the one that I liked the best was with NASDA, the Japanese Space Agency.

This involved almost every school across Japan. They had a hookup with schools throughout the nation, and it was very organized, and when they got the questions and answers, this was transmitted to thousands and thousands of students throughout Japan. It was an amazing program, and I am sure that it had a tremendous impact on their study there.

Our educational programs do not end from the time that we leave the Space Station, either. When we come back, we have an opportunity to go out and talk to schools and communities throughout the Nation. Both Yuri, Susan and I have spoken to many different schools and communities about space and the International Space Station, science and the value of science and mathematics, and that is a program that will continue for a long time, and not only in the future. I had a little contact with NASA in the past, and their education programs are comprehensive, and they are not just K through 12, or sometimes college. We have a lot of different programs.

My first contact was in 1980, when I was teaching at the U.S. Military Academy, and participated in the NASA faculty research program. It allowed me to learn about NASA research and interactive researchers there to further my education.

Another product that we have gotten from the Space Station, not intended, I think, initially to be an educational product, but it has become one, I believe, and that is the IMAX 3–D Space Station film. If you have not seen it, you should go see it. It really shows what it is like to live and work in space. It demonstrates our construction of the Space Station and how we lived up there, and I think it is wonderful tool for educating the general public on what we are doing in space.

I think as you will see when you hear from our students today, space exploration is a powerful motivator for young people, and it is a tremendous tool for teachers. It gets them involved in a hands-on way, they learn from it, and I really hope that they are inspired by it. I am very proud of the work that NASA has done to motivate, inspire, and to educate our young people, and I look forward to the future, when we will do even more.

Thank you very much for letting me provide you with my insight on my experience on the Space Station.

[The prepared statement of Colonel Voss follows:]

PREPARED STATEMENT OF COLONEL JAMES S. VOSS, ASTRONAUT, NASA

I appreciate the opportunity to appear before the Subcommittee today to share my thoughts on the power of space flight as a tool for inspiring the next generation of

explorers. During my five space flights, including 167 days on the second expedition to the International Space Station, my crewmates Susan Helms, Yury Usachev and I had the opportunity to interact with teachers and their students and to conduct education activities that I know inspired and motivated them.

The International Space Station provides a permanent orbiting classroom that brings education and research out of textbooks and into real life. The microgravity environment is the perfect classroom to demonstrate basic principles like Newton's Laws of motion. By integrating flight activities with inquiry-based learning, NASA offers students and educators the opportunity to participate in space missions and develop teamwork, communication, and problem solving skills.

NASA's in-flight education programs use the unique environment of space to inspire the next generation of explorers. Using tools of modern technology—including the Internet, a digital camera, and amateur radio and video downlinks—students are able to study and explore Earth from space, learn about life aboard an orbiting laboratory, and conduct demonstrations that illustrate scientific and mathematic concepts.

One of the educational payloads utilized on board the Space Station is the Earth Knowledge Acquired by Middle School Students (EarthKAM) program. EarthKAM is a NASA education program that enables students, teachers and the public to learn about Earth from the unique perspective of space. The image library and accompanying learning guides and activities are available to the public and support classes in Earth science, space science, geography, social studies and mathematics.

During Expedition 2, I set up the EarthKAM camera and conducted technical checkouts of the hardware. Our crew conducted the first operational cycles of EarthKAM onboard the ISS, and during the nine days it was operational 488 images were acquired. The EarthKAM imagery sites were selected by students and the camera was controlled in a way that very closely follows the process we use in conducting other scientific research. It is tremendously rewarding to know that these images were used by students nationwide to conduct earth and space research investigations in their classrooms.

While in space I also communicated with students using the Amateur Radio on the ISS (ARISS). ARISS is a NASA education program that offers the opportunity for students to experience the excitement of space flight by talking directly with crewmembers of the ISS via amateur radio. During the year and a half that we have had humans on board the International Space Station crews have had contacts with 65 schools in 26 states and 10 countries. These contacts involved astronaut crews on board answering questions asked by students while over 15,000 of their classmates listened. Many of the contacts were broadcast live over the Internet and most were covered by local, state and national news media. A typical reaction to the impact of one of these educational outreach contacts can be seen in a note I received from Mr. Allen White who coordinated my contact with Admiral Moorer Middle School in Eufaula, Alabama. Mr. White wrote:

> "Did the contact with the ISS have educational benefits? YES! Would we spend the time and preparation to do it again? YES! There is no way I can adequately describe the excitement this created in our school and community. I think this was the most exciting educational event of the year for these students. Nearly a hundred students submitted questions. All three of the science teachers at AMMS, the principal and school administrators supported this effort in every way possible. Interest in the space studies unit was heightened. The U.S. Space program and the ISS became real to both the students and our community because our kids actually talked directly to an astronaut in space! The space program was no longer just something they had read about. This event was the talk of the town for weeks!"

We also had the opportunity to conduct NASA Spaceflight Education Opportunities. This is a NASA education program that facilitates live, interactive programs between crewmembers onboard the ISS and students and educators in classrooms around the world. Expedition 2 participated in four live, interactive programs during their mission. These included the following:

Sioux City, Iowa—May 15, 200l. Topic: Research on the ISS.

San Francisco Exploratorium—May 23, 2001. Topic: Living in space and radiation.

NASDA (Japanese Space Agency)—June 6, 2001. Topic: Life onboard the ISS.

Cooper-Hewitt Design Institute, New York, NY—June 26, 2001. Topic: Technology and design.

In addition to the live programs, Expedition 2 downlinked an opening message for the Space Day 2001 activities.

NASA's Education Program is comprehensive and reaches beyond the K–12 education community to university students, faculty members and the public as well. In 1980, while teaching at the U.S. Military Academy, I had the opportunity to be a participant in the NASA Faculty Fellowship Program. Through this program I was able to gain research experience and participate in valuable collaborations with NASA researchers. An educational product of the ISS Program is the IMAX 3D Space Station film which was made in large part by astronauts on board the Space Station and has helped educate the general public on the assembly of the ISS and life in space. This Fall during the World Space Congress NASA will be leading the way in distance learning with an educational downlink from the Expedition 5 crew.

Space exploration is a powerful motivator for young people and is a tremendous tool for teachers. I am extremely proud of the work that NASA has done to maximize our country's investment in the Space Shuttle and International Space Station by using them as education platforms. Students, teachers, faculty, and the public will continue to be inspired, motivated, and taught using these national space assets.

Senator WYDEN. Very good. That is very helpful. Let us now—and I think we can arrange this with the Committee and with Mr. O'Keefe—let us have the testimony of Dr. Peggy Whitson via videotape.

Mr. O'KEEFE. Peggy has just arrived.

STATEMENT OF DR. PEGGY WHITSON, ASTRONAUT, NASA

Dr. WHITSON. Distinguished Members of the Committee, I am Peggy Whitson, and I am talking to you from the International Space Station. I wanted to take a few minutes of your time today and talk to you about how important education is for NASA and for our future. NASA has sponsored a number of projects here on the International Space Station for young people, including things like Earthcam, where we have mounted cameras here that were controlled by students on the ground, looking at targeted sites on the Earth. Other projects, like our ham radio projects, we have talked to children all over the world.

But today I want to spend a little bit of time talking to you about what we will be working with here during Expedition 5. This payload is the International Toys in Space project, and we are trained to use the allure of space flight to attract young people to the field of science, mathematics, and engineering, and we use different toys to try and demonstrate that.

For instance, we have this jumping bear on the ground. It works quite well, but here in space, after it reaches a certain point, it no longer works, so this could be an engineering project where young people try and develop or modify this toy so it would actually work in space, and it gives young people an idea of all the problems involved and the engineering involved in space flight.

Another toy that we have demonstrates a lot of the mathematics that are kind of key in space flight. We have three balls on one string, and the center one actually slides along the string, and I will demonstrate to you here in just a moment how we can use this for a demonstration where students can study inertia and motion centrifugal force, as well as some more complex math motions, and I will demonstrate this.

Then finally, all of you have probably played with marbles, but we have an extra added dimension here in space, being three-dimensional, and we also have marbles of very different masses

which we can use to demonstrate some very basic principles of mass and energy and motion, and the biggest challenge for me, of course, is not to lose all my marbles.

[Laughter.]

Dr. WHITSON. So we will take snapshots of these videos and incorporate them with videos on the ground to demonstrate to young people different aspects of science, mathematics, and technology. The International Toys in Space project includes the NASA educational division, the Houston Museum of Nature and Science, the Wright Space Institute, Miami University of Ohio, and the Houston Independent School District, and another project involving education that I wanted to talk to you about is one that I was involved with personally. This is a NASA program called the resident research associate program.

After finishing my graduate school, I was able to come to the Johnson Space Center using one of these fellowships, and not only did I have the pleasure of working of as an associate, but later I was an advisor for various associates that came to NASA, and I think it provides a great experience for young people as well as the people at NASA for providing new ideas and new blood in the system, so I think it is a great program we should expand on even more.

So thank you very much for your time, and again I would like to say that NASA obviously has had a large role in my educational goal, otherwise I would not be here, 240 miles above the Earth, in my own laboratory.

Thank you.

Senator WYDEN. Well, thank you very much, Administrator O'Keefe, for arranging that. We try to find ways to communicate an important message, and nothing could say it better than Dr. Whitson just did.

Mr. O'KEEFE. We had hoped to be able to do that live. Unfortunately, the satellite link was used to coordinate the landing of Endeavor, so we thought that would be a higher calling.

Senator WYDEN. I think so, and you tell Dr. Whitson we will give her another chance.

Mr. O'KEEFE. Thank you, Mr. Chairman.

Senator WYDEN. We will give her another opportunity. Thank you very much for arranging that.

Let us go next to Ms. Peggy Steffen, Albert Einstein Distinguished Educator from Ottumwa High School, Iowa.

STATEMENT OF PEGGY STEFFEN, ALBERT EINSTEIN DISTINGUISHED EDUCATOR, OTTUMWA HIGH SCHOOL

Ms. STEFFEN. Thank you. Science is all about questions. They may result from the simple curiosity of a preschooler, or the investigation of fundamental questions about the origins of the universe. Teachers of science like myself are challenged to lead the Nation's children in discovering answers to questions. NASA has been a partner with me as a science teacher in meeting that challenge during 25 years of learning adventures with teenagers in Iowa. We were inspired by the excitement of the Mars Pathfinder mission as images came from millions of miles away to our computers. My students became explorers themselves as they were challenged to in-

vestigate questions like, how can we find out how far an object in space is from Earth? Can we observe a planet surface that is covered in clouds, and how do ocean currents affect the climate and weather in Iowa?

The students quickly learned that recent discoveries in science are not found in the textbooks but with information made available through publications, activities, and from organizations like NASA. However, NASA is unique in that science is public. The flow of information about new discoveries and images is easily accessed by citizens, educators, and students. I have appreciated the availability of NASA resources through the electronic Spacelink library, through workshops, and through NASA Educator Resource Centers.

In 1985, I was excited about the possibility of a teacher being sent on the Space Shuttle to teach from Space. I was one of the thousands of hopefuls, but the program's message to my students, their parents, and myself was that education was important, and NASA was willing to provide resources and time on the shuttle to connect real science to all students, even those in small-town Iowa.

I am excited about the recent plans for the Educator Mission Specialist program. It will provide many springboards for education to be involved in the science of NASA. In 2000, I was chosen as one of 12 Albert Einstein Distinguished Educators from around the Nation, and was given the choice of several fellowship positions in Washington, D.C.

I chose NASA because of the enthusiasm and inspiration it generates in educators and students, and because I wanted to work in the organization that inspired me to choose science as a career. I have not regretted for one minute my decision to spend my Einstein Fellowship working at NASA. NASA's education program is an evolving one, dedicated to providing effective, meaningful opportunities for the Nation's educational communities. I have appreciated the willingness of the NASA family to reach out to practitioners in the classroom for advice and assistance in response to the needs of translating science and technology.

The NASA-Iowa Connection project was designed and implemented to bring rich learning experiences to Iowa's educational communities through the State's fiber-optic distance learning system. It has demonstrated how NASA's resources can provide extended professional development and student learning based on a theme, in this case, the International Space Station Student sessions brought opportunities for interaction with NASA researchers and university faculty. The staff of the NASA Food Technology Commercial Space Center provided special sessions with Astronaut Clayton Anderson. Participating schools received special kits of "astronaut lunches" for tasting and experimentation during the session, which was broadcast around the State.

Students were able to answer probing inquiries by the presenters, and were able to ask questions of the expert panel. One capstone event for students during the project was the Next Generation Space Station Design challenge. Middle school students worked in teams to develop a design for the next step in Space Station habitats. They produced models, a presentation and diagrams which were shared with other students through the distance net-

work and with the Distance Learning Outpost at NASA Johnson Space Center. Two of the models are displayed in front of you, along with an "astronaut lunch." The final event in the project is a downlink from the International Space Station crew to the Science Center of Iowa next week, in which we will hear from Iowan Peggy Whitson.

What is the impact of NASA's involvement in education?

Senator WYDEN. You Iowans get around.

[Laughter.]

Ms. STEFFEN. We do. I would like to offer a few quotes from people who were involved in the NASA-Iowa Connection project, the first from the teachers: "This project was valuable in many ways. It showed them what they were capable of, gave them a chance to explore/research independently, and do teamwork on an entirely different level." "This project introduced many of them to the idea of looking into engineering fields."

From a parent: "Thank you for providing this opportunity for my two sons. Their interest in aerospace was greatly increased."

And from our most important audience, the students in grades 3 through 8: This project "gives me another option for a future job. This will help me work harder." "It put an interest in science on me. It made me wonder what I want to be."

Thank you for the opportunity to share the perspective of a teacher. NASA's ability to inspire teachers and their students is powerful. I would like to end with a quote from student Blake Meyer's thank you note to Astronaut Clayton Anderson: "The time you talked to us taught me more than any book ever will. I will be watching for you and your crew to one day go up into space. Shoot for the stars."

Senator WYDEN. Well said. Well said, and we thank you, Ms. Steffen. Very good. Let us go now to Ms. Marci Whittaker from Oregon State. We have a special interest in having folks here from Oregon State, and we know the good work going on campus, and you just proceed, Ms. Whittaker.

STATEMENT OF MARCI WHITTAKER, JUNIOR NUCLEAR ENGINEERING STUDENT, OREGON STATE UNIVERSITY

Ms. WHITTAKER. Thank you, Mr. Chairman. My name is Marci Whittaker, and I am a junior nuclear engineering student at Oregon State University in Corvallis, Oregon. I grew up in a small farming and lumber community in Eastern Oregon, where education is not the top priority. It is difficult to interest parents and children in the pursuit of knowledge when mills are closing and crops are failing. However, I had an early advantage. Both of my parents graduated from college in scientific fields and were eager to encourage my education. They were receptive and supportive even when I told them I wanted to be the first professional basketball-playing astronaut in the CIA.

[Laughter.]

Ms. WHITTAKER. By my freshman year at Oregon State, I was earnestly working towards the more general rocket scientist career. I discovered that a small group of OSU undergraduate students were developing a project for NASA's reduced gravity student flight opportunities program. I was shocked. I did not think that I would

be able to participate in NASA programs until graduate school at the least. Participating in the reduced gravity student flight opportunities program has been at minimum a life-altering experience. This program allows students to design, build, and test experiments in the zero gravity environment of the KC–135 airplane.

Teams from community colleges, two Ivy League universities converge on Ellington Field in the spring and summer to experience NASA at its finest. I have now made three trips to Houston to take part in the student flight program, and each trip was awe-inspiring. Every person we encountered stayed until all of our questions were answered, whether it was the program coordinator, the test directors, interns we met in the hallways, or an astronaut we mobbed at the Johnson Space Center. The program test director stayed late on weekends so teams could finish their projects, and offered helpful points along the way.

Since the teams, each carrying anywhere from 4 to 12 members, worked in a hangar directly on the flight line, risks are numerous. The test directors are patiently accommodating to around 12 teams at a time, plus they are extremely safety conscious. Every concession is made to ensure that teams have a spectacular time at NASA. Family members are admitted, interteam activities are arranged, and spontaneous tours given.

As a side note, a great quote. I got the opportunity to take two freshmen on the team this last year, and they came back telling everybody they shook a space man's hand.

The true genius of the student flight program is that this inspiration and enthusiasm is passed from NASA to the program participants and from the teams to high school and elementary students. A requirement of the program is the outreach. Each team must speak about their experience to various groups upon returning home. For the OSU team, this has included speaking at high schools and elementary schools, and participating in summer programs like the OSU-developed summer experience in science and engineering for youth.

SESEY allows the small groups of students to work closely with the students' mentor and a professor to investigate cutting edge science and technology. All of the projects selected have a strong outreach plan and good, solid science, as one director phrased it. Good, solid science has ranged from testing components of a zero gravity waste filtration system to virtual reality programs to help program participants adjust to the dizzying effects of weightlessness. Teams focus on biological and mechanical aspects of space technology. An experiment on maintaining fitness and bone density is flown next to a machine that analyzes soil samples in space.

As with most good things, this program has a hefty price tag. An hour on the KC–135 runs at about $7,000 for private researchers. NASA provides this program to us for free. However, teams must pay for their own equipment and travel arrangements. Team budgets can range anywhere from $9,000 to $50,000, depending on equipment sensitivity and purpose. These funds are donated by universities, private companies, families, and the students themselves.

The national space grant college and fellowship program, another NASA program, has been very helpful in defraying the team's cost. Oregon's space grant has managed to put aside some funding for the OSU team every year. Space grant scholarships are also awarded each year. Each award is based on merit, need, and an essay on a selected space science topic. Since my nuclear engineering department is very supportive of nuclear space propulsion, the scholarships are always a hot topic. The essays also point to casual space enthusiasts, and to a more focused direction. Last year's essay asked applicants to develop an appropriate task for a pico, or very small satellite, I understand for the university's Cubesat project.

I consider myself very lucky to have both received a space grant scholarship and to have participated in the reduced gravity student flight opportunities program. I am now able to return to my home town and give students inspiration I once lacked. I am hoping that I will be able to make my fourth trip to Ellington Field this next year, and continue spreading NASA's inspiration.

Thank you.

[The prepared statement of Ms. Whittaker follows:]

PREPARED STATEMENT OF MARCI WHITTAKER, JUNIOR NUCLEAR ENGINEERING STUDENT, OREGON STATE UNIVERSITY

My name is Marci Whittaker and I am a junior nuclear engineering student at Oregon State University in Corvallis, Oregon. I am here to speak about the necessity of an inspirational education.

I grew up in a small town in Eastern Oregon where education was not the top priority. In a small farming and lumber community, it is difficult to interest parents and children in the pursuit of knowledge when mills are closing and crops are failing.

However, I had an early advantage. Both of my parents graduated from college in scientific fields and were eager to encourage me in my education. They were receptive and supportive, even when I told them I wanted to be the first astronaut to be a judge and a professional basketball player.

By my freshman year at Oregon State, I was earnestly working towards a more general rocket scientist career. I discovered that a small group of OSU undergraduate students were putting together a project for NASA's Reduced Gravity Student Flight Opportunities Program. I was shocked. I didn't think that I would be able to participate in NASA programs until graduate school at least.

Participating in the Reduced Gravity Student Flight Opportunities Program has been a life changing experience. The program allows students to design and build experiments and test them in the zero gravity environment of the KC–135. Teams from community colleges to Ivy League universities converge on Ellington Field in Houston in the spring and summer to experience NASA at its finest.

I have now made three trips to Houston to take part in the RGSFO program, and each trip has been awe-inspiring. I could not hope to work for a better company. Every person I talked to was as excited to be there as the first day they worked there. Everyone involved was extremely conscientious about making sure that all of our questions were answered, whether it was about the program coordinator, the staff, interns we met in the hallways, or an astronaut we mobbed at the JSC campus. Any engineering or science buff would have a great time at NASA, but I haven't seen a group of students act this excited since the Christmas gift exchange in kindergarten.

The true genius of the RGSFO program is that this inspiration is passed from NASA to us, to high school and elementary students. A requirement of the program is that each team must speak about their experience to various groups upon returning home. For the OSU team, this has included speaking at high schools and elementary schools and putting together summer programs. I am now able to return to my very small high school and give the students the inspiration that I was lacking. The students who spoke of NASA in whispers now send me emails about how they are going to college so they can participate in this program, too.

As a nuclear engineering student at OSU, I am always hearing about nuclear space propulsion. My department chair, and avid supporter of space nuclear reactors, is also the director of the Oregon Space Grant Program. The National Space Grant College and Fellowship Program has also been a big force. Each year their scholarships get the whole department in a space uproar. Last year's scholarship essay asked the applicant to develop a task for a pico-satellite. For a solid month I heard nothing else but space talk.

I have been extremely lucky to be able to receive a Space Grant scholarship and participate in the Reduced Gravity Student Flight Opportunities Program. I am hoping that my fourth year in college will be no less amazing.

Senator WYDEN. Well said, Ms. Whittaker, and I admire the aspirations you had. All I wanted to do was play in the National Basketball Association. You pushed considerably more than I did. Congratulations on all your achievements to date. I know you are going to have a lot more.

Let us here now from Brendan Dwyer and Christopher Broere. You guys have had such a big buildup already that we are really excited. What we normally do when people come to the Senate and talk about their concerns and their issues is have the parents introduce their children, and I think what I would like you to do, Brendan, and you to do, Christopher, is introduce your folks to me and to the Senate. Can you do that for me? How about have the parents standing up, and then you introduce them.

STATEMENT OF CHRISTOPHER BROERE AND BRENDAN DWYER, STUDENTS, OCEAN AVENUE SCHOOL

Mr. BROERE. This is my dad, Harry Broere.

Mr. DWYER. And this is my dad, Sean Dwyer, and this is my mom, Maureen Dwyer.

Senator WYDEN. Thank you all very much for coming. Let us hear first from you, Brendan, then we will hear from Christopher (just pull that microphone close to you, because it is sort of hard to hear).

Mr. DWYER. Well, we sort of have a presentation.

Senator WYDEN. Well, let's sort of do it that way.

[Laughter.]

Mr. DWYER. Who wants to start?

Mr. BROERE. I will.

Senator WYDEN. Just pull the microphone close to you, Christopher. Go ahead.

Mr. BROERE. Imagine if one day NASA asked you to build a design and launch structure for the most advanced space vehicle. The launch structure has to be light and very strong, and has to be able to support a structure many times its weight. It has to be able to launch the structure not just once, but over and over again with little damage. To make things even tougher, you have to make minimum specifications in height and width, and all you can make it out of is wood, cardboard, and glue.

Now imagine if NASA asked you to do this without any experience in mechanical designing or engineering. This exactly the challenge Brendan and I set out to meet in the NASA NSIT aerospace technology engineering challenge.

Mr. DWYER. NASA asked students across the country in fifth to eighth grades to design and build their own reusable launch structure from scratch using the same ideas that are used in the X vehi-

cle and the Space Shuttle programs. The rules seemed simple. The structure had to be over 5 centimeters in height, and large enough to hold a 35-millimeter film canister within the body of the structure. The structure had to be as light as possible. The payload was a 1 or 2 liters bottle filled with water.

The students had to build the launch vehicle using a 20-pound sand bag as a lever, propel it up a guide rail. The launch was a success if the payload reached an orbit of 1 meter off the ground. The launch structure had to be able to reach orbit without any damage at least three times. To build the structure, students were allowed to use only certain materials, cardboard, balsa wood, craft sticks, quarter-inch dowels, and a hot glue gun.

When we first started out, we did not think the objectives were that hard. We thought all you had to do was make a simple structure of wood and cardboard and use it to launch it without breaking. A piece of cake. We were dead wrong. It turned out the challenge was really a challenge. We learned this the hard way when our first test structure, T–1, exploded into a million pieces on its second launch, and after we gave each other high fives, but many models later we designed and built the structure Speedy 6. It launched payload almost seven times its weight over and over, and was only 1.4 percent of the total launch weight.

We ended up learning more than we thought we could from this project.

Mr. BROERE. Our first lesson was teamwork. We researched our structure and talked about ideas for designs. We studied many rocket designs for these launch structures. We sketched these structures, and talked about why they were built in certain ways. We also researched technology books that came from an engineering library. We tried to understand how a launch structure worked. We learned there are important parts to every structure. They were vertical struts, braces, a payload platform, and joints. Each part works like a team to transfer the energy during launch. Each part had to be the right size to work with the whole to distribute the stress. A good structure spread the force evenly during the compression of the launch.

After our research, we set out to move the launch and the payload rocket. The launcher was made of pine wood boards, and the launch lever was mounted on a board with a T-hinge. Under the board we had a launch pad with a metal guide rod. We mounted a ruler to the metal guide rod to measure the altitude of our test. If the rocket cleared 1 meter and made it to orbit, the launch was a success.

Once we made the launcher, we needed the thrust to launch the payload rocket. Energy for our launches came from a sand bag dropped on one end of the lever. The challenge rules required the bag to be at least a 20-pound bag. We wanted to do a test with a lot of energy, so we used a 30-pound bag. The only problem with the 30-pound bag was, we kept dropping it on our foot, so we came up with the idea of a pull-center pulley to help with the bag. We were building the structures.

Mr. DWYER. When we finished the launch, we designed and built our first series of models. We began testing the launches. The structures were our first hard lesson. All the structures failed, but

we studied the damage in the broken pieces and we learned a lot about how stress and energy flow through a structure at launch.

The braces were very important to the structure. The first models used horizontal and vertical braces and struts. We began to see that diagonal X braces might work better to help support the structure and reduce stress. By distributing energy, we also discovered we would have to begin to make the structures heavier and to make them stronger.

Mr. BROERE. We went back to the drawing board. We were not going to give up. When we began designing new models, Brendan and I began to have a dispute on what was the best way to handle the problem of strength. I thought cardboard was the key to strength. Brendan thought cardboard would increase the weight too much and we should use balsa wood and form the struts and braces, so our team began making two different series of models. One series, the BD series, tried wood. The other series, the CB series, my series, tried cardboard. By the end, we had narrowed our ideas down to two different styles, the model CB–2 and DB–4.

This is CB–2. It was the heaviest model, weighing 50.3 grams. The cardboard on all sides gave it most of its weight. It took some of the brace ideas from our earlier structures, and had cardboard on all sides to give it strength.

Mr. DWYER. This is what is left of the BD–4.

[Laughter.]

Mr. DWYER. The BD–4 used octagon-shaped base and it had a lot of wooden joints. This was the largest structure at 9 centimeters. We wanted to see if the size made a difference when it launched. We got our idea from one of Robert Goddard's rockets.

Mr. BROERE. We tested the new models again. This time we had a success, but at a price. The cardboard structure, CB–2, launched to orbit three times with a little damage, but it was just too heavy, and there was another problem. This was a real rocket with solid walls. It would have too much heat from the engine, so our team decided to take the best ideas from each model and combine them into one structure. The result was BD–6.

Mr. DWYER. This is BD–6. It has doubly enforced X braces and it took the best idea from each model, combined them into one structure. It had lighter joints. BD–6 was a complete success. It weighed only 29.3 grams, but it could launch a rocket that weighed 2,041 grams beyond an altitude of 1 meter without any damage. It could sustain the energy of a 13 kilogram weight dropped over and over from 1 meter. The best part was, the structure met 1.4 percent of the total launch rate.

Mr. BROERE. We discovered the final formula for our structure was a simple box, strong vertical struts, plus wider joints, plus cross-bracing in an X pattern on all four sides.

Mr. DWYER. Plus a payload platform supported by cross braces, plus the structure height of 6 centimeters with the lightweight wood materials doubly enforced, plus symmetrical measurement of all parts, plus careful gluing and, most of all, teamwork.

Mr. BROERE. Now we are going to demonstrate our launch.

[The launch was accomplished.]

[Applause.]

Senator WYDEN. Would you guys like to add anything else?

Mr. DWYER. No.

Senator WYDEN. As far as I am concerned, we ought to put you in charge of the Federal Government.

[Laughter.]

Senator WYDEN. I am not sure that anybody in Washington, D.C. is ready for a couple of guys like you that really follow up, but congratulations on a terrific job. That was really a good explanation as well. You talked about some pretty complicated stuff, and I was even able to understand some of it, so thank you very much for an excellent demonstration.

Do you guys want to add anything further?

Mr. DWYER. No.

Mr. O'KEEFE. Now you see why we want to recruit them, Mr. Chairman.

Senator WYDEN. I can tell your parents you are going to be signed to a multiyear contract before you walk out the door.

Let us do this. For a few minutes we are going to do this a little differently than we do most Senate hearings. I think, as I look at all of you at the table, the enthusiasm is just coming out of every pore, and it is palpable, your excitement and your interest, and I think what I want to do is spend a little bit of time just thinking through how we might build on some of these issues. I will have some questions for each of you, and this is not going to be some kind of typical congressional hearing where you get grilled brutally, and you are supposed to sweat constantly and the like. We are going to just think a little bit out loud in terms of some ideas about how we proceed.

Mr. O'KEEFE. Mr. Chairman, I am disappointed you are going to spare them the full experience.

[Laughter.]

Senator WYDEN. They will have it when they take over, but let us start with you, Administrator O'Keefe. First, from the standpoint of the goal that I have set out, the tripling of the number of women, how important would something like that be?

Mr. O'KEEFE. I think critically important. As a matter of fact, we are going to start with Marci, because the opportunity, I think, to motivate folks to consider these important disciplines fields for science, technology, engineering is the future of where we are going, and unfortunately it is not of sufficient numbers that we would see in order to really populate the aerospace community at large, or NASA very specifically.

I read a frightening commentary the other day—well, I should not call it frightening, but it certainly is awakening. There are more majors today at colleges and universities at sports and exercise science than there are in electrical engineering. As a consequence, in the future the opportunities to really focus on the kinds of areas that are necessary make that an imperative, and I think in terms of the very specific minority and gender distribution they are into, that means we really need to not only double our efforts, but triple them in so many different areas, and that is an awful lot of what our education efforts are about here, to inspire the next generation of all potential explorers, not just a few.

Senator WYDEN. Studies indicate girls begin to lose interest in the sciences around preadolescence and junior high school. Are

there some steps NASA can take to try to retain those girls' interests at that critical age?

Mr. O'KEEFE. Well, again, I think much of what we are attempting to do is target not only the college level interest and the current cohort of college students, because at that stage most have made up some decision about what kind of general area they are going to go into.

Again, regrettably you do not see many liberal arts majors switching to engineering degrees midway through college. If there is not an inspiration or motivation on the part of folks in elementary through high school to make those decisions, with Christopher, certainly, and Brendan to make the decision to be involved in this is typically not going to be a decision they will make past high school, so as a consequence it will be critical, I think, to focus our efforts at grade school as elementary as well as secondary high school level activities as soon as we can for the purpose of inspiring the next generation behind.

Senator WYDEN. Now, a subpart that question is that teachers' attitudes toward girls in the sciences are particularly critical to whether a girl decides to pursue studies in math and science. Are there steps that the agency can take to change the teachers' behaviors and attitudes towards girls in the sciences?

Mr. O'KEEFE. Well, I have a feeling that Barbara Morgan will be most influential in this activity as she becomes the first educator mission specialist, she has an extraordinary communications skill as well as just being a marvelous teacher, and she I think will motivate and inspire those in the teaching profession to change attitudes in that direction, because she is trained as a physicist. Her degree was from Stanford University, and so as a consequence she is very much focused in that direction and can speak quite authoritatively on the motivation or lack thereof that she got, and encouragement she got from so many as she moved through her studies in pursuit of math and science objectives, then to have become a grade school teacher, and a very successful one, in a way that now sees the applications that I think she can demonstrate that regularly, and we seek through initiatives like that to continue to emphasize by example, by demonstrating what we do, walking the walk in this regard of what we are capable of doing.

Peggy Whitson, another marvelous example, who will be the first designated science officer aboard the, International Space Station, a doctorate in biochemistry, and as a consequence is focused very directly towards those very important disciplines that will yield, in addition to the experiments she talked about here, the science objectives of what International Space Station will be capable of.

The more we demonstrate this, I think the more it becomes an example, a demonstration of our capabilities in this area.

Senator WYDEN. Now, you mentioned in your testimony NASA has a number of education programs that have been focused on women. There is the Goddard Space Flight Center sisters program, NASA summer or high school apprentice program, women in science and engineering program, and then you also have a partnership with the National Center for Women in Science, Technology, Engineering and Math.

Now, you said a big part of what you wanted to do was to look at these programs that the agency runs and try to reorganize them, come up with some ideas of how to best promote them, and decide if some will be changed or go by the boards. Can you give us some sense of how you are going to do that, and whether there are certain programs that you think are already producing especially significant results?

Mr. O'KEEFE. Yes, sir. Thank you. The focus is exactly as you described it, is to inventory what it is we are doing across the agency, which again is not an attempt to try and control those activities, but more to coordinate them in a way that we can leverage that for greatest gain and to, in the process of doing so, examine where the best practices and the best examples of outreach that we can attain and seek to transmit and transfer that kind of knowledge around the agency for greatest gain.

Our other effort, too, is to make sure we coordinate our challenges and our approaches to this through the Department of Education, and rather than try and go out and duplicate the kind of outreach efforts they have, as a matter of institutional practice today, and so as a result we will leverage again a lot of the programs we are focused on very specifically in ways that I think will be much more efficient as well as more targeted in our outreach efforts.

I do not think it is going to take more money. I think it is going to take more focus, concentration, and attention to how we do this and gain greater advantage, I think, by that approach. I would say a stellar example of what really has worked and has been a real effective effort is the establishment of research centers and a range of historically black colleges and universities which have motivated a larger, attention towards engineering, math and science, and technology discipline pursuits, the means and the actual application of those efforts toward very real projects and efforts that we are engaged in, and so they are conducting important research, a place like Prairie View, for example, that is beginning the efforts to look at the effects of radiation on astronauts for long-duration of stays.

As a result, they are really conducting some efforts there, but a major problem that we need to focus on in that area is to assure that we have an opportunity to recruit those who have been the participants in research center grants, scholarships, and fellowships through those important programs, so even that needs more attention, but it has been a marvelous experience, and one that, having met with so many representatives of those research centers, it has leveraged those resources in ways that we never could have imagined in accomplishing those tasks. We just need to do even more of it.

Senator WYDEN. What would you think about the idea of naming a point person to be in charge of the women's programs as a way to try to give some focus in this area, since upwards of 90 percent of the people in these key positions are men?

Mr. O'KEEFE. Well, we are headed towards, I think, the establishment of a senior leadership and management position within NASA headquarters for education objectives. There will be an organizational element that will look across the entire agency's func-

tions and all center activities, again, a means to coordinate this. In that effort, I am certain there will be attention and focus towards I think again the minority outreach efforts and recruiting objectives therein, as well as women and gender-focused kind of approaches to aim at recruiting as an ultimate effort and engage therein.

Let me mull that a bit, because the notion of really putting a specific emphasis on a specific area or group for that purpose may be the way to go. It may be an effort to focus very directly in areas that will have benefits in that regard, but there certainly will be a more coordinated, focused attention at the senior level of the NASA headquarters and across the entire agency in terms of how we functionally conduct education efforts across the board.

Senator WYDEN. I appreciate that response and your willingness to look at it, because I would very much like to work with you and Administrator O'Keefe to set some concrete goals, particularly with the employment of women. My sense is that you all are doing a lot of good work; I just could not be more pleased about the commitment that you are making, and my sense is that there are a lot of programs out there. There is a lot of activity, but I think we really need to see if Congress and the agency can jointly establish some specific goals that we can then measure.

For example, I think the visits are terrific, and I only want to encourage them, but I think the measure, for example, has got to be how many people we actually get with degrees in their hands and then moving on to careers. If we could work with you to try to find a way to set out some concrete goals in that area that would be very helpful. I want you to know how strongly I feel about this as chair of this Subcommittee that focuses on science and technology issues.

I have had a number of meetings with women around the country, and I am just struck—I mean, I really walk away sort of slack-jawed at the passion that they bring to this issue. There is tremendous concern that starting at a very early age, at that third and fourth grade environment, young women who have shown real aptitude and real skills somehow get waylaid. Teachers do not, in effect, give them that extra push, and a variety of things go wrong. I think that what we want to do is come up with a set of goals and a set of policies that help to turn this around; I can see how committed you are to the field, and I think now we want to work on some of the nuts and bolts of how to do it.

Mr. O'KEEFE. Yes, sir, I would be delighted to work with you on that, absolutely.

Senator WYDEN. I appreciate your passion for this effort. Let me get some of the other witnesses involved, and then we will go back to Mr. O'Keefe for some other questions.

For you, Astronaut Voss, my question would be, with so much activity on the International Space Station—particularly now when you are building the Station—how do you make time to conduct experiments and programs with students? You have got to be juggling a lot of hats out there.

Colonel VOSS. We do stay awfully busy up there, that is for sure, but you know, it is like everything else we do, most of the things we do are scheduled for us. They tell us what to do and when to

do it, and there is a grand plan in place to get all of the many, many requirements completed during an expedition, and our planners on the ground factor in all of the tasks we have to do, whether there are assembly space walks, robotics, interior work—there are so many different things. Education is one of those many pieces of this puzzle that they fit together and put into our schedules.

Every week we have some sort of contact of one sort or another, and it was part of our normal plan. It was part of our normal work. It was part of our mission while we were up there, and that is how we completed a lot of it. We also had some free time, not much, but some, and we were willing to devote that time as well to these ham radio contacts with schools and other activities because we share that passion that our Administrator has for education, and believe, deeply believe that is part of our role, that we should be trying to inspire that new generation.

Senator WYDEN. That really leads me to the only other question I had for you. You know, when you are an astronaut, there are a tremendous number of pulls on your time. You could be involved in a whole host of issues. Why did you decide to make education the priority that you wanted to focus on, when there were a bunch of other things that you could emphasize?

Colonel VOSS. I believe in a lot of those sayings that people have that we're inspiring the next generation, that we are touching the future, as Christa McAuliffe said, things like that. I really do believe that is what happens when we teach our children, whether it is a teacher, a professor, an adult, a parent, and I really do believe that is the way we guarantee the future of our Nation and the world, so I guess I just believe that, and it is worth the effort and the time that we put into it. It is important.

Senator WYDEN. All right. Ms. Steffen, you obviously have put a lot of work in curriculum development, and you are in the classroom, and nothing is more helpful than to have that sort of real world sense of what is happening in a classroom. Tell us a little bit about how you have been able to integrate the various different disciplines of NASA science into the programs that you are a part of.

Ms. STEFFEN. As a science teacher, I have taught almost all the sciences, though I have emphasized physics, astronomy and geology in the last 10 years, and my classroom strategies have been inquiry-based learning, and challenge-based learning, so NASA resources, since they do cover all disciplines, have been very easy to incorporate into the research challenges that I give the students and the expectations that I have for them to go out and find good recent science discoveries and how science is applied. They have come back with some wonderful things.

The projects that I have brought today are not from my students. They are from other students in middle school classrooms who were involved in project, the NASA-Iowa Connection, but my students, as older students, have done all kinds of things on a little different level using NASA resources, and a lot of it online.

Senator WYDEN. What do you think we can do with teachers to better address this issue of young girls, particularly in third and fourth grade, who seem to get waylaid from these careers? I ask you again. You are on the front lines, and you are part of the con-

verted. You obviously have this passion, and it looks like it is in your chromosomes to me. What is your sense about how we could deal with what sure seems like a real problem out there—that is getting those teachers in those critical grades, like third and fourth grade, to do more to generate opportunities for women?

Ms. STEFFEN. A couple of possibilities. First of all, we do know a lot more, based on research, about how different children learn, both male and female, at different ages, and we need to do a better job of putting that research into our curriculum development areas, and that is Nation-wide, not just NASA.

But also, we need to put an increased emphasis at the elementary ages. It has been my experience as an educator of teachers, in addition to being a teacher in the classroom, that elementary teachers are not very comfortable with most science content, therefore they do not spend a lot of time emphasizing that content, since they do not feel comfortable to answer student questions, so it would be, I think, a great in-road into making girls feel more comfortable in science if their teachers spent class time on that also. We need to increase opportunities for professional development at the elementary level with teachers, helping them to learn the content so that they go back and work with the students I think this would make a big difference to girls in the classroom.

Senator WYDEN. The same question, Marci, what is your sense of how we get more young women involved? I gather that your situation was one where you got it from your parents. If you had not gotten it from your parents, what would have happened? You just would not have gotten it at all?

Ms. WHITTAKER. Well, let me tell you an example. I moved on to a slightly larger high school, and my senior year they encouraged most of the advanced students to take either advanced biology or physics.

I had a good friend who is very, very smart, a female, and she would not take the physics, not because she did not think she could handle the materials. She knew she could handle it. She just did not feel comfortable being in an environment where she was a minority, and I think that is the key to this, is to encourage not only girls that they can go ahead and do science and engineering-related fields, but to encourage boys at a young age also that these girls can handle the material, so that it is not an oddity to have a girl in your science and engineering class, or your physics class, or whatever. It is just a perfectly normal environment.

Senator WYDEN. Tell me about what it was like earlier on, though, because you just mentioned senior year and an advanced placement class. That was one set of issues that we have got to deal with and this question of being alone is obviously key, but what was it like earlier in third and fourth grade? You said you grew up in rural Oregon.

Ms. WHITTAKER. I think like Peggy said the teacher is uncomfortable with the material and so not a lot of time is spent on it, and I think most importantly when we do stuff, when they had science, the science period of the day, we need to do a lot of hands-on, get people excited, get kids into projects, and relate it not only to science but to other aspects of life, do practical projects, and I think that would help and bring in more guest speakers, more people,

adults or role models for these kids, because it is hard when you are little to see why this is important, and why you need to be learning this.

Senator WYDEN. That would be one, Mr. O'Keefe, that I had thought about as well—to have what amounts to science ambassadors. I am just speaking in sort of a colloquial, conversational way, but if, for example, there could be people with expertise who were interested in and committed to this field who could just get out and do some speaking for the agency to youngsters in third or fourth grade, I think that would make a real difference.

We are going to have to look at this in terms of a continuum, but it seems to particularly start at third and fourth grade with a different set of problems.

Anything else, Marci, you think you ought to be talking about as we work with the agency to try to get more young women in the field?

Ms. WHITTAKER. I think a very important thing that I have learned through this is that NASA is this big, mythological place that you go to if you are extremely, extremely lucky, and more an ambassador that goes out and contacts people and just more programs where people can come back and do outreach and talk to elementary school students, or whatever, and share their knowledge and their experience, most importantly to get them excited about it would be the most helpful.

Senator WYDEN. Well said. Well, Brendan and Chris, just a couple of questions for you. Certainly your rocket launch was impressive, and I can tell you two are excited about space. Tell me, what was it particularly that got you interested?

Did you watch shuttle launches on television? What was it that got you particularly interested in these fields. Pull the microphone to you, and if you want you can even put into this answer—I know, Brendan, you are interested in becoming a robotic engineer, and Chris, you are interested in computer science, so just tell us a little bit about what got you interested in all of this.

Mr. DWYER. Well, I like building things. In this project you build a lot of things out of wood, and you construct different things, and I build robots and stuff like that, and so that is why I like this. That is why I was interested in this project.

Mr. BROERE. I just like the computer field because I like building things, too, but I like math and stuff, and I am sort of good in math, and I like the computer, along the computer lines, and I really did not know what this project was about at first, and like, I am good at physics, and that is sort of computering, and so I sort of liked the whole project.

Senator WYDEN. Well, you guys have been listening for an hour and a half, or 2 hours, what would you like to see the people who run the space program do at your school?

Mr. DWYER. Well, I would like them to come in and have a link to the Hubble Spacecraft and the Space Station, like a radio.

Mr. BROERE. I would sort of just like somebody from NASA to come and maybe speak to my school.

Senator WYDEN. Good. That is like Marci, I think. That has certainly got a lot of students involved, and it is also something that is fairly straightforward and a little bit easier to put together, so

we are going to talk to Mr. O'Keefe about that speaker's program, and it is a good idea.

Just a couple of other questions, and then we can wrap up. Mr. O'Keefe, I think I was interested in your comments about the minority university research program. That is something that this Committee has had a longstanding interest in on a bipartisan basis, and I know that you are going to work with the various stakeholders in the minority community on it. Tell us what your plans are for addressing these issues which are so important to this country as well.

Mr. O'KEEFE. Yes, sir. First and foremost, if I could just comment real briefly on your last discussion, we do about 2,000 school visits a year with astronauts and engineers from around the agency, and you can bet that Ocean Avenue School will be on the list in short order, no doubt about that. In terms of more specific outreach efforts, we have had a continuing effort, I think, to look at fellowships, scholarships, and grants at historically black colleges and universities, as well as Hispanic institutions, and it has been on the rise for the last several years.

In the aggregate, for all the efforts we do on minority outreach programs, it aggregates on the order of about $125 million a year, of which 83, I guess, is at HBCU's, and specifically focused towards research centers and a few other areas. The dollars aside, though, it is more a question, I think, of two areas that we need to be really concentrating on very specifically for these programs.

First is to view this as a very specific part of our human capital objectives, strategic management thereof, to borrow a direct term right off the President's management agenda, as a means to look at how we are going to deal with the challenge of really what is right now, in the most charitable way of saying it, a very mature workforce, as you describe.

A third of the agency will be eligible to retire in the next 3 to 5 years, and so we have got to look proactively at every effort we are engaged in on how that then results in recruiting opportunities, and with the efforts that we are engaged in very directly at HBCU's as well as Hispanic institutions, there are opportunities there we have not tapped to the fullest.

The second element I think is that by creating the programs as appropriately so as an equal opportunity focus and objective, there nonetheless needs to be a very clear linkage with the education efforts overall so as to establish as part of the overall objectives, because in the end, regardless of where folks are who have been beneficiaries and direct participants in various NASA fellowships, grants, and scholarship programs, if, in turn, we are contributing to a larger national knowledge base, regardless of where they pursue professional opportunities thereafter, that is a benefit, I think, to all of us as Americans, and so in that regard, to look at this as an education effort, as part of our longer term commitment and obligation to our American objectives in this regard is reward enough.

Senator WYDEN. I think that is something that Brendan, Chris, and Marci can take away from this as well. What Mr. O'Keefe is basically saying is that he is going to need a lot of trained people like you. This is an agency that is going to need you very, very

badly in the years ahead, and I hope that will be a bit of an inspiration for you three and other students as well.

I also wanted to ask Mr. O'Keefe to talk a little bit more about the teacher in space program, what you hope to accomplish there, and how it relates to science and math education.

Mr. O'KEEFE. Well, the teacher in space program was, I think as Jim Voss, and certainly as Peggy described, as one of the applicants several years go to that effort in 1985, was a specific objective as a means to recruit teachers who would have the opportunity to experience space flight and then have an opportunity to take that one experience and translate it back in the classrooms.

The educator mission specialist effort is different in the sense that we are in pursuit of teachers, educators, who have an interest in pursuing the full astronaut training effort to be full participants in all range of activities that we are engaged in on the shuttle, as well as on the International Space Station, and the activities overall that are primarily dominant in our Earth-bound condition in their training efforts to be fully qualified participants in the Astronaut Corps, and who, by the way, view their task from the unique vantage point of that of an educator, of a teacher who look at issues, look at capacity, look at capabilities as a way to translate that to other educators and, indeed, to children as well, for larger education objectives.

That is a unique perspective that we have not seen, and we have seen a wide range of disciplines that represent those in the Astronaut Corps. Of the 120 active members of the Astronaut Corps today, roughly 40 percent are military. The other 60 percent are civilians from a wide range of backgrounds as engineers, scientists, physicians, marine research experts, you name it.

There is a wide range of disciplines and backgrounds they all bring to this, and as a consequence, view what they do from that unique vantage point of their perspective and discipline of what they do as they participate in what is necessary to be an astronaut, and participate in every single mission objective for the year to year-and-a-half that each of them train for each of those missions leading up to the activity.

Our opportunity with Barbara Morgan and those who follow after our national recruiting objectives have been to always have the opportunity of utilizing our capacity in a way to see how it translates to a classroom to inspire that next generation of explorers.

Senator WYDEN. What would you think of the idea of a student in space program?

[Applause.]

Senator WYDEN. And I brought this up having a feeling that might be the reaction. I did not want to see you trampled to death with applications on your way out of this hearing room, but I think it is worth exploring, and I would very much like to explore this with you.

Obviously, there would be a variety of ways to do it; for example, pull together a group of leading students from around the country and begin discussions with students and teachers and NASA officials. I think for purposes of today I would just ask, could we begin some discussions and start thinking about it?

Mr. O'KEEFE. Well, I hate to say this, Mr. Chairman, but Brandon and Christopher already beat you to it. They lobbied me pretty hard earlier today about what are we going to do about a kid in space. I think at this stage of the game we have to remember, we have to always remind ourselves that where we are right now in the space exploration effort is really at the very beginnings.

There is a poignant passage I read the other day from David McAuliffe's piece on John Adams that described the circumstances 200 years ago of the USS CONSTITUTION laying at harbor, and unable to get underway because the weather was inclement for 9 straight days.

Now, if 200 years ago that was the most formidable power projection asset the world had ever seen, and it sat there because of weather conditions, interesting. *The Endeavor* that just landed today was delayed 3 days because of weather conditions over Kennedy Space Center. It was delayed 6 days in launching because the weather was not exactly optimum for launch.

This is still a very early business. We are in the period of initial days of sail. In space exploration, we are aspiring to the days of steam equivalency for space exploration, and we are not there yet, so as a consequence it takes a wide range of extraordinary talented folks of the scientists, the engineers, the thousands of them that support every one of those launches, and then the folks who agree to take on these challenges as part of expedition crews for International Space Station as well as Space Shuttle orbiter crews that are trained in a wide range of disciplines, backgrounds, who are all participants.

This is not an opportunity yet for tourism or for expansion of those activities in ways that is beyond the scope of their constant participation in efforts that need to go on, so my aspiration I think is to position ourselves so that we can at some point say, this becomes an accessible means for every American who chooses to do so to consider this, but until then we are counting on and relying on Jim Voss and his extraordinary colleagues to help us blaze that trail in this early day of sail, of trying to accomplish space exploration objectives

Senator WYDEN. Well, I understand your concern. I just think that what is needed here is to be bold, and to set goals, and I think you would find that this would really trigger a tremendous amount of enthusiasm among students. I think that the students I have talked to about this want to meet the rigorous goals and the tough standards of NASA.

They are not interested in being tourists, and paying to just go up for the sake of going up and looking around. I think they understand what NASA's mission is all about, and I think that what we would find in terms of students is that students would be reluctant to do it unless they could do it right, unless they could do it in line with the rigorous standards that NASA has a right to expect.

So I would only hope—and I feel a little badly about just hitting you cold with the idea. Your commitment in this area is extraordinary. I am very appreciative of it, and I would just like to continue some discussions with you and really wrap it up this way.

It seems to me that NASA's work in the math and science area is particularly critical right now. We have the serious problems like

a dire shortage of women in these critical fields. We badly need the talent as it relates to our economy as a whole. We need this talent to win the war against terrorism, where technology is so vital to getting the jump on the terrorists and having people that know how to use it, and then, of course, we need to meet the tremendous needs you are going to have to deal with the workforce that is going to be leaving soon, so I think this is a particularly important bit of work for our country.

I am very pleased that you have staked this out, Administrator O'Keefe, as something that will be important to you. I think that this is something on our watch that we want to see real progress made. I think that means being bold, I think it means setting goals, and in particular it means building on the inspiration that you have all shown this afternoon. We have a tradition in this Subcommittee of giving the witnesses the last word. You are not required to take it, but we would like to give you the last word. Is there anything any of you would like to add further, Brendan, Chris, Marci?

Ms. WHITTAKER. I would just like to thank you, Mr. Chairman, and NASA as a whole for the opportunity to reach so many people through this program. Thank you.

Senator WYDEN. Very good. Mr. Voss, Ms. Steffen, Mr. O'Keefe?

Ms. STEFFEN. I just want to thank you for the opportunity to share some of my experiences today, and I am excited about some of the new opportunities that are coming on the horizon with NASA, and looking forward to being involved as a teacher.

Colonel VOSS. I just want you to know there are lots of young people who work at NASA who are very enthusiastic about their work and their jobs, whether it is being an astronaut, or a physician, or an engineer, or a scientist. We have lots of people tremendously enthused about their work there. We do not all have to be astronauts.

Senator WYDEN. Well, bumping up against you it would be physiologically impossible not to be excited.

[Laughter.]

Senator WYDEN. Mr. O'Keefe, anything else?

Mr. O'KEEFE. Thank you, Mr. Chairman. I just want to thank you and express my gratitude to you for your willingness to conduct such a hearing on a very, very important topic, and one that I think you can see, just from the witnesses here today, and my thanks to all of them for their willingness to participate in this as well.

I think the benefits that can be derived if we concentrate and coordinate our efforts very carefully in thinking about how we do this, and one of the great parts is, having spent a little time yesterday, Jim and I did, with Tom Cruise and the IMAX folks who produced the film that he mentioned earlier as really a must-see down at the Air & Space Museum and IMAX theaters the country. It is the closest thing he has ever seen that actually provides an understanding of the experience he had, but their interest and their enthusiasm for continuing these efforts to include the ideas of maybe looking at a second effort that will focus on the educator mission specialist missions hereafter, which is really quite an effort to inspire the next generation of explorers.

Thank you, Mr. Chairman, for your willingness to do this.

Senator WYDEN. We will be working closely with you in the days ahead. The Subcommittee is adjourned.

[Whereupon, at 4:15 p.m., the Subcommittee adjourned.]

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