COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS FOR 2014

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

SUBCOMMITTEE ON COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES

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PART 7

	Page
National Aeronautics and Space Administration Budget Request	**1**
National Aeronautics and Space Administration Inspector General Budget Request	**119**
National Science Foundation Budget Request	**167**



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COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS FOR 2014

WEDNESDAY, MARCH 13, 2013.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WITNESS

HON. CHARLES F. BOLDEN, JR., ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CHAIRMAN'S OPENING REMARKS

Mr. WOLF. The hearing will come to order. Good morning. I would like to welcome everyone to today's hearing on the National Aeronautics and Space Administration. Our witness is NASA Administrator Charles Bolden.

We appreciate your being here.

We are going to have a vote about 2:25, and then we will come right back. And then I think the next vote is at 4:30 or so, and I think hopefully we will finish by then.

As I mentioned in the subcommittee's first agency budget hearing yesterday, we are operating in an unusual environment this year due to the lateness of the President's budget request and the uncertainty about when the request will finally be submitted by OMB. As a result, we will spend less time today discussing NASA's specific budget proposal for next year and more time talking about general priorities and about issues that reflect on how NASA is managing the money that it has.

Some of those issues, such as the regular occurrence of cost and schedule overruns on major NASA programs, are longstanding concerns. Others, like NASA's management strategy for assisting commercial partners in the development of new systems for crew transportation to the International Space Station, are relatively new. For a large and broad agency such as NASA, there is a nearly endless supply of these type of issues that we could focus on as part of the discussion about how to make NASA the most effective manager of its funds.

One issue, in particular, I want to spend some time on today is the quality of enforcement within NASA's internal security regime. It is critically important for us to have confidence in NASA's ability to protect sensitive technologies and information from exploitation by entities that are looking to gain an advantage over the United States economically or militarily.

The subcommittee has worked very hard over the past few years to protect our research and development programs from the full impact of recent budget reductions. But we cannot continue to do this if NASA cannot assure us that those investments will be adequately protected from entities and countries that have been designated as potential threats.

One of the designated countries of greatest concern is China. We know that China is an active, aggressive espionage threat and that, according to a recent White House report, the technologies that NASA works on, aerospace and aeronautics technology, are those that the Chinese have most heavily targeted. I suspect that this focus on stealing space- and flight-based technology explains at least some of the major advances that the Chinese space program has made over the past few years.

Those advances challenge both our preeminent position in human space flight, but also international security, as China's space program is run exclusively by its military, the People's Liberation Army. For all these reasons, I am particularly attuned to any allegation that a lapse in security has provided China or any other designated country access to sensitive information that is supposed to be protected under our export control laws and other relevant statutes.

As you know, several allegations involving both the Ames and Langley Research Centers have recently been brought to my office by NASA career civil servants. These are all career people who have had a long history of service; no one is of a political nature. These allegations have raised concerns about NASA's ability to control sensitive information at events or on the Internet, its ability to appropriately screen and supervise foreign nationals working on NASA's programs or with access to NASA's information, and its ability to respond to possible security violations in a timely and comprehensive manner.

One of these allegations, centered on the access of Chinese national Bo Jiang to a sensitive technology at Langley, culminated this past weekend with Jiang's arrest at Dulles Airport, where he was attempting to return to China in possession of a large amount of information technology that he may not have been entitled to possess.

So this is not a theoretical discussion. We are talking about real people and real allegations of substantive violations, some of which are currently being investigated by law enforcement authorities, which we will not get into.

I would like to discuss the problems facing NASA's security enforcement regime, as well as some of the potential solutions. I hope we can get you to improve upon security. And I asked my staff to call over there because this can be a hearing on NASA espionage, or it can be a hearing on the space program. And so, that is why I am waiting to hear your comments. I have yet to hear any formal reaction from NASA to those recommendations, and I hope that the silence is not an indication of disinterest or a lack of commitment.

I plan on staying with the issue, and I assume the whole committee will help me. But even if they don't, I will be there because I feel very, very, very, very strongly about these issues. I believe that those specified reforms are necessary steps and we have to do

these things. So there is more that I could say about that, but we'll have some questions as we begin. Hopefully you can help us early on on that. That means we'd spend less time on these issues. If not, we'll spend more time.

But pursuant to the authority granted—oh, I want to recognize Mr. Fattah for his opening statement.

Mr. Fattah.

RANKING MEMBER'S OPENING REMARKS

Mr. FATTAH. Thank you. Thank you, Mr. Chairman.

And to Administrator Bolden, it is an honor to have you before the committee again. And I want to say at the outset I share the chairman's concern that we do—and I know that as someone who has worn the uniform of the country and who has done just an extraordinary—has had an extraordinary life of public service, that you, too, share any concern around dealing with protecting our national security and intellectual property.

But I want to make some more general remarks. One is I had the honor to be at the Jet Propulsion Laboratory in Congressman Schiff's neck of the woods for the occasion of the Curiosity rover landing, after 8½ months' travel, landing perfectly on the surface of Mars.

I think that NASA's team, in pulling off this extraordinary feat, really puts and positions NASA well in terms of the President's goal of seeing a human flight to Mars in the not-too-distant future. And I know about the work that is being done to put together the most powerful engine ever and the other work that is critically important for this effort. But the Mars rover and its landing, I think, really suggested to the Nation in a way that even late President John F. Kennedy would have been proud of, I think, really that NASA was really at the very forefront.

And I know you have dozens of missions, you have lots going—a lot going on. Sometimes it is hard to get the Congress and the country to focus on how successful NASA truly is. But I think this particular event really did galvanize the Nation.

And I got a chance, while I was in that area, to also visit and see the progress on the James Webb Telescope and a number of other activities, including SpaceX, which has become one of the two commercial carriers who successfully now—as was envisioned when the President and NASA made this decision to move aggressively in terms of commercial crew and commercial cargo.

And so there's a lot that we can look and see in terms of your life and work. We appreciate your presence before the committee today. And I know these are some difficult times, trying to imagine what your budget may be. And, as you mentioned to us the last time you testified, you know, this is rocket science, and there are risks involved, there are challenges. But you have helped navigate this agency at a very difficult time in terms of mission and in terms of some of the challenges in terms of fiscal uncertainty.

So welcome again, and look forward to your testimony.

Mr. WOLF. Thank you, Mr. Fattah.

ADMINISTRATOR'S OPENING REMARKS

Pursuant to the authority granted in Section 191 of Title 2 of the United States Code and clause 2(m)(2) of House Rule XI, today's witness will be sworn in before testifying.

Please rise and raise your right hand.

[Witness sworn.]

Mr. WOLF. Let the record reflect that the witness answered in the affirmative.

Administrator Bolden, your written statement will be made part of the record. You may proceed and summarize as you see appropriate.

Mr. BOLDEN. Thank you, Mr. Chairman.

Mr. Chairman and members of the subcommittee, I welcome this opportunity to discuss NASA's continued progress in implementing the bipartisan program for NASA agreed to by the President and the Congress, which will ensure the United States continues to lead the world in space exploration, technology, innovation, and scientific discovery.

NASA is developing space flight capabilities to send humans to an asteroid in 2025 and onto Mars in the 2030s. We're building the world's most powerful rocket, the Space Launch System (SLS), and the Orion Multi-Purpose Crew Vehicle (MPCV) for deep space exploration. In 2014, a little more than a year from now, we'll have the first test flight on Orion. Its first uncrewed test with an uncrewed flight of Orion and the SLS together is planned for 2017. The first crewed mission of the two vehicles is scheduled for 2021.

The knowledge we're gaining from the American astronauts living and conducting research on the International Space Station is critical to our future in deep space. In the coming year, we will prepare a year-long stay by a U.S. astronaut to explore human adaptation to space. We've begun commercial resupply of the station from American soil. SpaceX conducted its first resupply mission to the ISS in 2012 and is currently berthed to the ISS on its second resupply mission. Orbital Sciences Corporation is preparing for the maiden flight of its Antares rocket and plans its first mission to the Station later this year.

NASA is on track to send our astronauts to space from American shores using American companies by 2017. In critical support of the broader mission, we're developing and testing future technologies that will enable us to move and operate faster and more efficiently in space, land more mass accurately on another planet, and enable new destinations. Our ambitious aeronautics research agenda will reduce fuel consumption, emissions, and noise to make the Next Generation Air Transportation System (NextGen) a reality.

With 60 missions observing the Earth, the Sun, the planets, and the universe, NASA remains the world's premier space science organization and the critical source of information on the home planet. Building on the brilliant success of our Curiosity rover on Mars, NASA plans a robust multi-year Mars program, including a new robotic science rover based on the Curiosity design, set to launch in 2020. NASA is on track for the 2018 launch of the James Webb Space Telescope (JWST), the most powerful telescope in history.

In closing, Mr. Chairman, I want to address an issue of particular concern to you and me. That's securing sensitive export-controlled information at our NASA facilities. As you know, earlier this month, NASA completed a review of a potential security breach at our Langley Research Facility involving a Chinese national who worked for a contractor there. We referred this matter to appropriate law enforcement officials, and the person in question no longer works at Langley. We continue to fully cooperate with law enforcement officials investigating this current matter and stand ready to assist in any way we can.

I also want to report on several additional steps that I have taken to address concerns you have raised and which I share.

First, I've ordered a complete review of the access which foreign nationals from designated countries are granted at NASA facilities, as well as our security procedures with regard to these individuals more broadly. This is in addition to reviews being conducted by the NASA IG and others. My intention is to assess the need for an independent review, which you called for in your press conference, once these steps of internal review, are complete. Second, I've closed down the NASA technical reports database while we review whether there is a risk of export-controlled documents being made available on this Web site. Third, I have ordered a moratorium on granting any new access to NASA facilities to individuals from specific designated countries, specifically China, Burma, Eritrea, Iran, North Korea, Saudi Arabia, Sudan, and Uzbekistan. Fourth, while this review is ongoing, I have also ordered that any remote-computer access to NASA resources be terminated for those from the same specific designated countries. Fifth, NASA has also been working very closely with law enforcement agencies on security and counter intelligence issues and will continue to do so. Sixth, the review I have directed is also being accompanied by a renewed emphasis to our supervisors and the workforce on the importance of our security protocols, including assessments of new training that may be needed.

Mr. Chairman, just before coming over here, I had the privilege of doing a video teleconference with all of our export control officers at each of the NASA centers who are having a meeting at the Stennis Space Center this week, and we reemphasized the issues that are of concern to you and me.

Finally, I want this committee to know that I placed a priority on protecting security, export control, and safety compliance funding from any budgetary impacts from sequestration, and my team will continue working under that guidance. NASA takes all your allegations of security violations, and those from anyone, very seriously and follows a long-established procedure to investigate them quickly and thoroughly. These investigations are handled by our security and counter-intelligence professionals in cooperation with the NASA Inspector General and other appropriate law enforcement officials. The Agency is focused and committed to preventing and prosecuting all security violations. Mr. Chairman, I just want to add, this is about national security, not about NASA security. And I take that personally. I'm responsible, and I will hold myself accountable once our reviews are completed. With that, I thank you, and I look forward to your questions.

[The information follows:]

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BY WITNESS
March 20, 2013

Statement of
The Honorable Charles F. Bolden, Jr.
Administrator
National Aeronautics and Space Administration

before the

Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
U.S. House of Representatives

Mr. Chairman and Members of the Subcommittee, I am pleased to have this opportunity to update the Subcommittee on NASA's continuing progress in implementing the bi-partisan program for NASA agreed to by the President and Congress, which will ensure the United States continues to lead the world in space exploration, technology, innovation, and scientific discovery. We are developing spaceflight capabilities to send humans to an asteroid by 2025 and on to Mars in the 2030's. We are building the world's most powerful rocket, the Space Launch System (SLS), and a deep space exploration crew vehicle, the Orion Multi-Purpose Crew Vehicle (MPCV). American astronauts are living and working in space on board the International Space Station (ISS), conducting an expanding research program with an array of partners. With the help of American companies, we are resupplying the space station and launching these missions from U.S. soil, and we are on track to send our astronauts to space from American shores in just the next few years. In critical support of the Agency's broader mission, we are developing and testing future technologies that will enable us to move and operate faster and more efficiently in space, land more mass accurately on another planet, and enable new destinations. Our aeronautics research is making air travel cleaner, safer and more efficient. With 60 missions actively observing the Earth, the planets, the Sun and the Universe, we remain the world's premier space science organization and the critical source of information for an understanding of Earth's climate that can only be gained from the global perspective of space. We are extending these cutting-edge capabilities with major new developments, including the James Webb Space Telescope and a new Mars rover for 2020. Despite an uncertain budget climate, NASA is delivering the world's preeminent space program, supporting an innovation economy and broadening our experience of the universe around us.

As is briefly described below, NASA's resources are directed to accomplish the goals set for the Agency by the Congress and the President. We continue to pursue these long-range plans within a budgetary environment that can be difficult to predict. Our improved processes for cost estimating and program management play a critical role in our ability to manage within this difficult resource environment, and we remain on track in our major developments. NASA is confident that we can continue to execute the program described below within the budget levels anticipated in the President's FY 2013 request for NASA. We will attempt to maintain and implement long-term development plans within future budgets as they are appropriated. Budget stability has been identified by multiple expert panels as a primary requirement for efficient project execution in development programs, such as those that form the core of our efforts. The Agency stands committed to executing our program as efficiently as possible within the budgetary constraints we face.

Earth Science

Seventeen Earth Science missions currently in orbit study the home planet as an integrated system, including the recently launched Landsat Data Continuity Mission (LDCM), which is currently undergoing on-orbit checkout. NASA missions continue to give us a global perspective on how the climate works as a system and how it is changing over time. Few products of NASA's research can be as valuable, in a material sense, as an accurate understanding of the future of the climate. NASA is working to complete and launch three new Earth science missions in FY 2014, with a fourth scheduled for launch in Fall 2014. The Global Precipitation Measurement (GPM) mission, a cooperative mission with the Japan Aerospace Exploration Agency (JAXA), will to help provide global precipitation observations and the Orbiting Carbon Observatory-2 (OCO-2) will provide accurate global measurements of atmospheric carbon dioxide levels. NASA will install the Stratospheric Aerosol and Gas Experiment III (SAGE III) on the ISS to continue critical long-term measurements of the vertical structure of aerosols, ozone, water vapor and other important trace gases in the upper atmosphere. In the fall of 2014, NASA will launch the Soil Moisture Active Passive (SMAP) mission to study the Earth's hydrologic cycle.

Astrophysics and James Webb Space Telescope

NASA is on track and making excellent progress on the James Webb Space Telescope, the most powerful telescope in history. The Webb telescope is the next in a series of astrophysics missions, including the venerable, yet still unrivaled Hubble Space Telescope and the incredibly productive Kepler exoplanet mission, which are revolutionizing our understanding of the universe. After launching in 2018, the Webb telescope will travel one million miles from Earth, unfold its sunshield to the size of a tennis court, and keep its instruments cooled to a temperature of 370-387 degrees below zero Fahrenheit (40-50 degrees Kelvin). The Webb telescope will allow us to observe objects even fainter than the Hubble Space Telescope can see, which will allow us to study every phase in the history of our universe, ranging from the first luminous glows after the Big Bang, to the formation of solar systems capable of supporting life on planets like Earth, to the evolution of our own solar system. In the coming year, NASA plans to finish the Webb science instruments, begin their testing as an integrated science payload, and commence construction on the spacecraft that will carry the science instruments and the telescope. NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA) airborne observatory is making its second year of science observations. Operating at altitudes of between 39,000 to 45,000 feet (12-14 kilometers) and above 99 percent of the water vapor in the atmosphere, SOFIA makes observations that are unobtainable from telescopes on the ground. In the coming year, SOFIA will begin its next set of science observations; flying out of Palmdale, California, and Christchurch, New Zealand, SOFIA will observe star-forming regions in our galaxy from its vantage point at the top of the Earth's atmosphere.

Planetary Science

Building on the brilliant success of NASA's new Curiosity rover on Mars, NASA has announced plans for a robust multi-year Mars program, including a new robotic science rover based on the Curiosity design set to launch in 2020. The current portfolio includes the Curiosity and Opportunity rovers; the 2013 Mars Atmosphere and Volatile EvolutioN (MAVEN) orbiter to study the Martian upper atmosphere; the 2016 Interior Exploration using Seismic Investigations, Geodesy and Heat Transport (InSight) mission (which will take the first look into the deep interior of Mars); participation in the European Space Agency's 2016 and 2018 ExoMars missions; and the new Mars rover planned for launch in 2020.

Last summer, NASA's Dawn mission completed more than a year in orbit around the asteroid Vesta, and departed for its 2015 rendezvous with Ceres, the largest known asteroid. NASA is developing a robotic asteroid rendezvous and sample return mission, dubbed OSIRIS-REx (for Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer), which is planned to launch in 2016. After traveling three years, OSIRIS-REx will approach the Near Earth Asteroid1999 RQ36, map the asteroid, and collect

a sample of up to 2.2 pounds for return to Earth; this mission will provide valuable data and experience in support of NASA's planned human exploration of a Near Earth Asteroid.

Heliophysics

Perhaps even more dynamic than the Earth's climate are the processes taking place within the Earth's nearby star, the Sun. NASA's Heliophysics Program operates nearly 20 spacecraft to expand our understanding of the Sun, its complex interaction with Earth, other planetary systems, the vast space within the solar system, and the interface with interstellar space. Last year saw the successful launch of the Van Allen Probes, which, in a few short months, have already redefined our understanding of the Earth's radiation belts. The coming year will include final development and launch of the Interface Region Imaging Spectrograph (IRIS), as well as continued development of the Magnetospheric Multiscale (MMS) mission, which is planned for launch in 2015 to investigate how the Sun's and Earth's magnetic fields connect and disconnect. NASA continues to formulate the Solar Probe Plus (SPP) mission and develop its contribution to the European Space Agency's Solar Orbiter mission.

Aeronautics Research

NASA's innovative aeronautics research supports the Nation's aviation industry's efforts to maintain competitiveness in the global market. Our research provides the flying public with an improved flying experience and fewer delays, while also maintaining an outstanding safety level. NASA's breakthrough research into more efficient air traffic management and environmentally friendly aircraft helps U.S. air carriers to operate their fleets more efficiently while reducing operating costs. Today, we are pursuing an ambitious research agenda for substantially reducing fuel consumption, emissions and noise to make the Next Generation Air Transportation System (NextGen) a reality. Looking ahead, NASA is paving the way for further industry innovation through demonstration in flight of new aircraft wing technology designed to save fuel by reducing weight and drag, and continued flight research of low-boom technology designed to reduce sonic booms enough to eliminate the barrier to overland civil supersonic flight. By advancing the state of the art in vehicle and air traffic management technology, NASA is directly contributing to the Nation's bottom line. In recent years, civil aviation has accounted for $1.3 trillion in U.S. economic activity annually, and employed over ten million people. It has provided the Nation with a $47 billion positive balance of trade.

Space Technology

Space Technology enables our future in space by drawing on talent from the NASA workforce, academia, small businesses, and the broader space enterprise to deliver innovative solutions that dramatically lower costs and improve technological capabilities for NASA and the Nation. In 2012, we successfully fabricated a 2.4-meter composite cryogenic propellant tank. We will scale this design up and test a 5.5-meter diameter tank to enable lower mass rocket propellant tanks that will meet future SLS needs. The Small Businesses Innovation Research and Small Business Technology Transfer (SBIR and STTR) programs saw six previously funded technologies make their way to Mars last August with the landing of Curiosity. In 2014, we will fly a cluster of eight CubeSats that will make coordinated space science observations. We will also conduct high altitude tests of new full-scale parachute and drag devices designed to enable precise landing of higher-mass payloads to the surface of planets. In addition, NASA will launch the Sunjammer Solar Sail, which will demonstrate solar sail propulsion as an advanced space weather warning system. Over the past two years, Space Technology engaged over 100 U.S. universities and academic institutions with approximately 350 activities, including fellowships, direct competitive awards and through partnerships with NASA Centers, small businesses and commercial contractors. We will continue releasing a steady stream of new solicitations, tapping into the Nation's talent to ensure the availability of advanced technologies. Following the National Research Council's review of the Space Technology Roadmaps, the Agency released and is implementing the key tenets of the Strategic Space Technology Investment Plan. NASA's community of innovators are applying, testing, and reworking cutting-edge research into potentially "game-changing" solutions that can accelerate a timeline, slash

projected costs, or multiply science return. NASA makes progress in essential space technologies daily, enabling more capable and far reaching future space activities for our Nation.

Exploration Systems

NASA continues to meet its milestones in the development of the SLS, a rocket system ultimately capable of bringing an unprecedented 130 metric tons of payload to Earth orbit. The Orion Multi-Purpose Crew Vehicle (MPCV) program continues on schedule for an uncrewed test flight in 2014. This test flight, Exploration Flight Test-1, will see Orion conduct two orbits of the Earth and reenter the atmosphere at a high speed characteristic of a returning deep space exploration mission. The test will provide valuable data about the spacecraft's systems, most importantly, its heat shield. The flight test article for this mission is already in place at the Kennedy Space Center and being readied for this test. The first uncrewed test of the Orion and the SLS together, known as Exploration Mission-1, is planned for 2017, with the first crewed mission of the two vehicles slated for 2021. These two missions will test and demonstrate these systems in Earth-Moon space, providing a foundation for future human deep space exploration missions. Together, the SLS and Orion MPCV represent a critical step on the path to human deep space exploration.

International Space Station

Deep space exploration will be made possible by building on the knowledge and experience the Agency is gaining by having American astronauts living , working, and conducting research on the ISS. Every 90 minutes, an international crew of 6 orbits the Earth aboard the football field–size space station. Our plans for the coming year include preparing for an extended duration, year-long human-crewed mission to explore human adaptation to space, and the addition of three Earth Science instruments that will exploit ISS' capabilities to study winds over the oceans and the movement of dust, smoke, and pollution through the atmosphere. The Center for the Advancement of Science in Space is now managing the National Laboratory research being done on ISS by an array of organizations, including commercial researchers interested in taking advantage of this unique, microgravity facility.

Commercial Crew and Cargo

A top priority for NASA and the Nation is to affordably and safely launch American astronauts and their supplies from U.S. soil, ending our reliance on foreign providers and bringing that work back home. Under NASA's Commercial Resupply Services (CRS) contracts, Space Exploration Technologies (SpaceX) was awarded 12 cargo flights to the space station, and Orbital Sciences Corporation (Orbital) was awarded 8. SpaceX executed its first cargo mission to the ISS in October 2012, successfully delivering its cargo and returning scientific samples to Earth. SpaceX is currently flying its second CRS mission, and its Dragon spacecraft is slated to return to Earth on March 25. Orbital is preparing for the maiden flight of its Antares rocket in April; they will then conduct a demonstration flight of the Antares with the Cygnus spacecraft this spring, followed by Orbital's first contracted mission under CRS later this year. NASA continues to work with its commercial partners to develop a commercial capability for human spaceflight. NASA intends to procure commercial crew services to ISS by 2017. Through the successful execution of this partnership, we will return to the United States the vital capability to launch astronauts to the ISS and return them to Earth. Because our commercial space partners continue to make rapid progress toward meeting the Agency's requirements for access to the ISS and to low Earth orbit, NASA is able to focus its human exploration resources to develop the deep space capabilities represented by the SLS and Orion MPCV.

Conclusion

NASA thrives on the synergy created by a critical mass of brilliant scientific and engineering talent. We work, as an Agency, to send humans to an asteroid and on to orbit Mars. We work, as an Agency, to understand the universe from the beginning of time to the future of Earth's climate. The people working

to put the next rover on Mars are refining the systems necessary to put humans there in the future. The people testing advanced ring-sail parachutes for landing payloads on planetary surfaces are also learning how flight through an atmosphere at super-high speeds works. The astronauts running physical science experiments on the ISS are themselves life science experiment subjects, and at the same time, they are demonstrating the science and technology for living and working in space. The Agency is on track and making steady progress executing the space program defined for us by Congress and the President in the 2010 Authorization Act, and we are confident we can accomplish the programs we have undertaken under that direction. NASA's confidence that we can execute the program described here is based primarily on the demonstrated expertise, flexibility, and dedication of our people. The reason why NASA ranks as the best place to work in the Federal government may simply be this: We all are contributors to a mission greater than ourselves, extending beyond the current generation. We tackle national and global challenges. We are explorers.

Mr. WOLF. Well, thank you, Mr. Administrator. I appreciate that.

FOREIGN ESPIONAGE THREAT

And I want the record to show that there was a whole series of questions, and I will still ask a handful, but not to the degree that we were planning. I do appreciate your response. I think that's very important.

And let me just reiterate what Mr. Fattah said of your record in service to our country and the military—and also your son's service to our country and the military—in addition to your time in the space program. So I know that you're concerned. And so I appreciate you acting quickly.

In light of the arrest of NASA's contractor Bo Jiang over the weekend, I had asked yesterday—and Mr. Fattah was here—the FBI Director, Director Mueller, in our hearing whether NASA's centers are significant targets of foreign espionage. Director Mueller responded, "Certainly, they are targets, yes. And it is a significant threat. We recognize that it has a significant threat."

He went on to say, "If anything, I would say that the threat is more substantial than perhaps it was 10 to 15 years ago." Again, the FBI Director believes that foreign espionage is a significant threat to NASA centers and is, "more substantial than it was a decade ago."

So I think both NASA and the Congress have to work together to heed his words carefully.

There were a number of questions that I was going to ask you which I will just submit, now, many of them for the record.

INDEPENDENT EXTERNAL SECURITY REVIEW

The one question, though, that I think you did not cover directly was, will you appoint an independent, outside panel led by someone like former Attorney General Dick Thornburgh or someone of similar stature to comprehensively review and audit security protocols and enforcement, including foreign national access and export controls at every NASA center and headquarters? And will this panel have unrestricted access to center personnel and records and report back to the Administrator and Congress within 6 months on its findings and recommendations?

I want to just clarify, Director Mueller used this same approach for the FBI. When 9/11 took place and Director Mueller was appointed, there was a transition. And he embraced the National Academy of Public Administration; we had a former Attorney General, Dick Thornburgh, do a review. It was very, very successful. Other committees have used NAPA.

So the question is, would you comment on this outside panel?

Mr. BOLDEN. Yes, sir.

Mr. WOLF. You sort of directly said it, but——

Mr. BOLDEN. I did, Mr. Chairman. When I read the actions that we were taking, and the first one that I said was I had ordered a complete review, that review is being done by the Associate Administrator, Robert Lightfoot. I gave him specific written directions as to what I want done.

I have talked with the head of my Office of Protective Services, Mr. Joe Mahaley. Joe has actually said he feels that it may be that

an review of the type that you mentioned would, in fact, be very helpful. So since he is doing an internal review of the Office of Protective Services, our security and export control; Robert is doing an internal review of all the centers. We've requested data. We just want to make sure that we get all that in and know what the depth of our problem is. As I told the export-control officials this morning, they should probably expect that within a week or so I probably will direct that we go out and ask NAPA—specifically NAPA, since that was who you suggested—to do an external review.

Mr. WOLF. Sure.

Mr. BOLDEN. I didn't make that commitment——

Mr. WOLF. No, I think that's very fair.

Mr. BOLDEN [continuing]. Specifically, but that is my probable intent.

Mr. WOLF. No, I think that's very, very fair—and that that's appropriate.

Mr. BOLDEN. Yes, sir.

COMPLIANCE WITH STATUTORY RESTRICTIONS ON CHINA COOPERATION

Mr. WOLF. We have a vote on, and then we'll leave with 5 minutes left. But just to kind of narrow down a couple things, for more than 2 fiscal years, NASA has had a statutory restriction on its cooperative activities with China.

When the subcommittee wrote the restriction, we intended to prevent all access by official Chinese visitors to NASA facilities unless advanced notification and certification are provided. Are you interpreting these restrictions in this way?

Mr. BOLDEN. Mr. Chairman, as we discussed in your office, I still believe that our staffs have a difference in legal interpretation on the law as it's written. And we interpret it to be a restriction with relation to bilateral activities with China. What I have pledged to do is that, since I don't interpret it to include multilateral operations, such as the International Space University, when we made a call to the staff——

Mr. WOLF. I agree.

Mr. BOLDEN. Yes, sir, I think we agree, but I just want to make sure. What I have said I will do from here on out is, as a courtesy, even if it's multilateral, we'll let you know that we have something that's coming. But we don't anticipate having a Chinese visitor to a NASA center here anytime soon.

SECURITY CONTROLS AT NASA CENTERS

Mr. WOLF. Good.

In a letter dated June 20th, you had answered a question. You said, as described more fully in the cover letter, there were 156 Chinese nationals that were working at NASA facilities. I've heard the figure is now up to 200.

Can you comment on how many there are and, also, how many Americans are working in PLA facilities in China?

Mr. BOLDEN. Yes, sir. Mr. Chairman, we have now done a thorough, we hope, search. We have 281 foreign nationals from designated countries who have physical access to NASA facilities, and, of those, 192 are foreign nationals from China.

Mr. WOLF. One-ninety-two.

Mr. BOLDEN. So the number is 192 Chinese foreign nationals.

Now, that number includes people with green cards and with visas. So, that 192 are the ones who have been impacted by the actions that I took with reference to access to different things that NASA does.

Mr. WOLF. Because in June of 2012, it was only 156. So the trend is really going up, rather than down.

Now, how many Americans work in Chinese facilities, PLA facilities——

Mr. BOLDEN. Mr. Chairman, I will get back to you for the record, but we have checked, and, to my knowledge, we have no NASA personnel or personnel who are under a NASA contract, NASA grants, or anything else who are working in the People's Republic of China. There are probably many Americans who are working in the People's Republic of China——

Mr. WOLF. Right, but I meant in the People's Liberation Army, the space facilities.

Mr. BOLDEN. We have none from NASA who are working there. The issue that we still owe you is, do we have anyone who is working on a NASA grant or who may be affiliated with an organization that's working on a NASA grant but their work also takes them to a PLA facility? That is what I have to get back to you for the record.

[The information follows:]

FOREIGN NATIONALS

Answer: No NASA employees work in Chinese facilities. The Agency does not have insight into the work location of non-NASA employees.

Mr. BOLDEN. As an example, there may be an engineer who is working on a NASA grant but his real job requires him, working for Boeing or someone else, to be at a PLA activity, not doing anything NASA related, but doing their primary work. I don't have that information right now, but we are trying to get that.

Mr. WOLF. Okay.

Are you aware of any incidents in which NASA has encouraged an external entity, as they did down at NASA Langley, to undertake with its own funds a cooperative activity with China that would be prohibited using NASA funding?

And are you going to be clarifying that with the contractors? Because there was almost a workaround to get around the subcommittee language. Will that be part of what you're looking at, too?

Mr. BOLDEN. Mr. Chairman, because you complimented Lesa Roe, the Director of Langley, the other day in the hearing, I respectfully disagree with the implication of what you just said. I don't know whether you meant to say it or not. But Lesa and her people are not attempting to use contractors as a workaround to the rules. We would not do that. As a matter of fact, we really feel that we have been fully complying with the law, that our processes are strong.

What I have determined is that, as any organization of our size, we may have some gaps in compliance with those processes. I think that's what probably happened down at Langley. But we were not

attempting to work around the law or the system or anything. Lesa Roe is one of the best center directors I have, and she would not attempt to use a contractor to work around the law.

Mr. WOLF. Okay. Well, NIA did. I'm not going to go into the specifics because of the investigation. But we saw something where one NASA person says, "you know, there are times that we should follow the regulations, but then there are times that we should ignore the regulations." And——

Mr. BOLDEN. Congressman, that's what I'm saying. That is an allegation that I have been unable to substantiate. We're the best place to work in government. I don't say that lightly. We're the best place to work in government based on an Employee Viewpoint Survey. I went back and looked at that survey to find out if there were people who had indicated in the survey that they were afraid to come forward with violations of the law or export control violations. We rank among the top in the government as to people who say they trust their leadership, they have no qualms about coming forward with a violation of any kind. What our employees have told us in the Employee Viewpoint Survey that made us number one in government is incongruous with what the person or persons told you when they came in and brought you the report from Langley.

Mr. WOLF. Well, we had people from Ames and we had people from Langley——

Mr. BOLDEN. Yes, sir, I understand.

Mr. WOLF. We had a total of five.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. All career people. And you can think about this for a moment, but, if you like, we could contact them. They were all concerned about their jobs.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. But we could—and I would trust you implicitly, if you would want—I would contact them and set up a meeting where just you came, no one else, to meet with them.

But they were very, very concerned. And, also, they had lost confidence. And I'm going to end this because I told you that we're not going to keep driving this.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. But they were not really very pleased with the IG. And I, frankly, have not been pleased with the IG. I have not been pleased with the IG at the local level, nor have I been pleased with the IG at the national level.

So the whistleblowers were intimidated, they were fearful. I will give you the quotes, and I can——

Mr. BOLDEN. No.

Mr. WOLF [continuing]. Go through some of these things. If you want, you let me know.

Mr. BOLDEN. Congressman, that's really not necessary. As I told you when we met before, no one was more bothered and concerned about these allegations than I. As I said in my opening statement, I hold myself personally responsible. So I have tried to assure every single member of the 18,000 members of the NASA family that if they have a problem they can come into my office. I reemphasize that frequently. I am bothered at the effectiveness of my leadership if I have five people who say they don't trust me to come

forward and tell me that they think there's an export violation. I don't need to know who they are. Even 5 out of 18,000 bothers me, as a leader, that they don't trust me and they don't trust their center director to come forward and say, We know of an export violation.

Mr. WOLF. Okay.

Mr. BOLDEN. That's what they're saying.

Mr. WOLF. Okay. Well, I was just—we're down to 5 minutes.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. If I were an employee, I would trust you to come in. I may not trust some other people——

Mr. BOLDEN. That's my point, sir. You don't even——

Mr. WOLF [continuing]. And so you think about it.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. We're going to end because we're down to 5 minutes on this.

If you want, you give me a call, and I'll ask them to come on in.

And, secondly, I appreciate your willingness to do all these things. If you could contact the committee when you make the decision with regard to NAPA, I would appreciate it.

Mr. BOLDEN. Yes, sir, we will do that.

Mr. WOLF. With regard to that, we'll be in recess until this—I think there are two votes.

Mr. BOLDEN. Yes, sir.

[Recess.]

Mr. WOLF. Before we go to Mr. Fattah, Mr. Aderholt is part of the delegation that went to Rome for the installation of the Pope. He wanted to—would you agree to meet with them and talk with him?

Mr. BOLDEN. Sure. Yes, sir.

Mr. WOLF. Okay, good.

Mr. BOLDEN. I'd be glad to.

Mr. WOLF. Mr. Fattah.

Mr. FATTAH. Thank you. Thank you, Mr. Chairman.

And let me thank the Administrator.

And before I go forward, I do want to just put into the record a little bit more about your military service. You flew over 100 combat——

Mr. BOLDEN. Yes, sir.

Mr. FATTAH [continuing]. Missions. And you served as a deputy commanding general for the First Marine Expeditionary Force in the Pacific. And you were also in Kuwait during Operation Desert Storm. Is that correct?

Mr. BOLDEN. Desert Thunder.

Mr. FATTAH. Desert Thunder.

Mr. BOLDEN. That was between the big ones.

Mr. FATTAH. All right. I want the record to reflect your tremendous service——

Mr. BOLDEN. I didn't want to take credit for something I didn't do.

CENTER FOR THE ADVANCEMENT OF SCIENCE IN SPACE (CASIS)

Mr. FATTAH [continuing]. To our country.

And now let's move to your—the work that you are engaged in now.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. For more than a decade, for every single day we've had a human being—human beings on the space station doing important scientific work. NASA has been engaged in a transition that has been very successful, to create the space station now, after building it and constructing it, into our newest Federal laboratory.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. National laboratory. And the engagement between NASA and CASIS has worked out well. And I met with the board here when they were in Washington and was very energized about the great research effort that is going on.

So if you wanted to just spend a minute and talk about how that has proceeded.

Mr. BOLDEN. I sure would. I would love to, sir. Thanks very much for the opportunity. CASIS is a private entity. NASA wanted to get out of the business of having to be responsible for recruiting and managing experiments and researchers in the U.S. Segment of the International Space Station for a number of reasons.

When I used to be in NASA, people used to always complain that NASA was guilty of doing junk science. I never believed that, but one of the things that we felt we could do is if we handed it off to another independent organization outside of NASA, it would bring credibility to the work that was being done on the Station. The members of the board, they are pretty influential people and pretty prominent and well-known in the science and technology community.

So CASIS was stood up. It is a part of Space Florida. Again, Space Florida has been an incredible entity. It is the business-development arm, if you will, for space for the State of Florida. We've learned how to work very well with them. As a result of CASIS, we are having more and more non-NASA people that don't even have anything to do with NASA who are now wanting to fly on the International Space Station.

We are about to put up some Earth science instruments on the Station. That was not done before. I was led to believe that Station was not a good platform for Earth science. That's not true. We're about to put up a cosmic ray instrument on the Station. The Station was not good for cosmic ray science; that's not true. So as a result of having an outside entity that helps us evaluate people that want to fly, we're able to put additional assets to enhance the utilization.

What we hope that it will prove, it will be a model for the other partners. Because the U.S. Segment is only one part of it. All of our other partners, the Russians, the Japanese, the Europeans, they are all evaluating how CASIS works for us and thinking about a way that they could do a similar thing. Because everybody is faced with ways to cut down on the operating costs, the daily cost of running the International Space Station, And it's proving to help us.

COLLABORATION ACROSS AGENCIES

Mr. FATTAH. Well, I'm quite impressed with the work that is being done there, and I know it could not happen without NASA's full partnership in it.

Now, we just had the head of the National Science Foundation in yesterday. And, in part, he was talking about his—the great work that they are doing. But he mentioned his and the agency's involvement in the standup of this new observatory in Chile.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. And, of course, you know, we have other observatories, like in Hawaii and the like. And we have the Hubble. And now as the Webb Telescope starts to come into view, can you help the committee understand how all of this interacts one to another and gives us a better sense of——

Mr. BOLDEN. Sir, the big thing is collaboration across agencies. The new observatory in Chile is one that we will utilize. I had a hearing yesterday with the Science Committee on asteroids and NEOs, near-Earth objects. The observatory in Chile will give us another instrument that we can use for identification and tracking.

We have a number of different places around the world. A number of them are National Science Foundation-sponsored, if not -funded, facilities. So we take advantage of the collaboration with the National Science Foundation to get information that helps us determine identification and characterization of asteroids, as one example.

We fly out of Punta Arenas, Chile, every year. We go down into the Antarctic. We actually do some work that is in collaboration with the National Science Foundation again. It's our Earth science efforts, from airborne Earth science. When we go north, it's called IceBridge. I think we call it the same thing in the south, but I don't want to say that because the ice guys will tell me I don't know what I'm talking about. But we fly toward both poles to do ice research. A lot of that is done in collaboration with the National Science Foundation also.

NASA'S EDUCATION PROGRAM

Mr. FATTAH. And the last point I'll make in this round is, I had an occasion to go speak at a conference on severe weather events. You know, obviously, we've had the most, in terms of aggregate number, one after another, the most severe weather we've ever seen.

But it was fascinating because a number of the experts at NOAA, which is also under our committee's jurisdiction, who operate the National Hurricane Center, actually, some of them were educated through NASA's education program. And I had a chance to meet with your education team. And the hundreds and hundreds of scholarships and fellowships that NASA has provided, you know, have an impact far beyond.

So, for instance, when we had Hurricane Sandy, the fact that they were able to pinpoint exactly the location that it was going to hit actually saved lives, saved——

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. So, you know, NASA's benefit is far beyond space exploration, and it helps right here on Earth in so many different ways. So I want to thank you.

And if you—if you could talk a little bit about the education work, because I know you've made this an important part of your leadership. That will be my last question for this round.

Mr. BOLDEN. Yes, sir. I try to be a good follower, and when I interviewed with the President, one of the things he told me that he wanted to be done was he wants to increase the number of engineers in STEM fields that come out of this country. Since the days when we would bring people in from other countries, educate them, train them, and they would choose to stay here and become citizens, it doesn't happen that much anymore. They tend to go back home now, for a variety of reasons. So we've now got to train our own, because we don't compete right now with other nations in terms of producing engineers.

Many times it's because we just don't have the number of people. I'm not excited when people cite the number of how many more engineers China creates than we do. Well, how many more people do they have? So, if you say a percentage of the population, we're probably as good as they are, but we're not good enough.

So NASA really focuses on STEM education, and it's STEM education K–12. This committee and the Appropriations Committee from the Senate have been very good through the years to make sure that we have adequate funding for a number of programs—the NASA Space Grant program, MUREP, and others that allow us to focus our efforts into underserved communities, where we can try to enhance the numbers of young people, who get interested in STEM curricula. So it's a passion for me. It's a passion for Leland Melvin, who is the Associate Administrator for Education, and we're trying to help Secretary Duncan to have the best Education Department in the world.

Mr. FATTAH. All right. Well, thank you.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. Thank you, Mr. Chairman.

Mr. WOLF. Mr. Culberson.

FY 2013 APPROPRIATIONS CONCERNS

Mr. CULBERSON. Thank you, Mr. Chairman.

General Bolden, thank you for your service to the country and all that you do at NASA. You know how strongly we all support you and how passionate this subcommittee is. And the Congress has been really arm-in-arm in working together to support NASA and do everything we can to keep America's space program the best in the world.

And looking forward to the day in the near future when anytime the NASA Administrator appears, the room is packed, you know, you've got as much excitement out there in the country as there was when I was a kid growing up in Houston and remember vividly the Apollo program and the tremendous excitement that the whole country felt. Those days are coming again, but I think it's not for lack of effort on your part or the part of the Congress.

I personally think NASA is spread too thin. There's too much interference politically with what you do. And how do you plan any

big, complicated, expensive rocket or spacecraft with the pillar-to-post, year-to-year budgeting/appropriations cycle you've got to deal with?

So Chairman Wolf and I are working, as you know, on legislation that we would look forward to your help and support on to try to give NASA some more stability and predictability, let you buy rockets and spacecraft the same way the Navy buys aircraft carriers and submarines with multiyear procurement, to give you and your successor. As I think Chairman Wolf has told you, we'd be delighted to see even you be, once our bill passes, you be the first new director of NASA would be just fine. But give you more stability, like the FBI Director, overlapping administrations. We look forward to working with you on that.

And in terms of looking to the future and what lies ahead for NASA and the manned program and the planetary program, could you talk to the committee a little bit about the effect of the—the Senate is—looks like they're going to act today or maybe later today and pass the five appropriations bills, with a CR for the others, that will include the CJS bill, which is a—contains language that Chairman Wolf and Senator Mikulski have worked out that's got strong support both in the House and the Senate.

Talk to us about that appropriations bill for 2013 that you're going to see for the remainder of the year and what that means for a heavy-lift rocket, which I did not see in your opening statement, and also for the planetary program.

Mr. BOLDEN. Sir, as the NASA Administrator, I'm always happy to get whatever the Congress chooses to appropriate. Though the mark is what I would consider to be close to what we asked for, it has some shortcomings that will cause us problems down the road. Those shortcomings are exacerbated by the fact that sequestration was allowed to take effect. On top of any reductions, there's another 5 percent across-the-board reduction.

Two areas that have me significantly concerned right now are commercial crew, because, I tell people all the time, we have an interdependence in our exploration program right now. And so those who remember back in 1972, when the original Space Transportation System was proposed, it was a three-prong program that had routine access to space, an orbiting space station, and what was called an orbital maneuvering vehicle that was going to allow us to go back to the Moon, go from space station to space station, and then allow us to go to distant planets. That was a long time ago, that was long before I came to NASA, but that was the vision.

We didn't do right back then. We decided that we could only afford one. when you take a triangle and you take a leg away, the triangle falls. That's exactly what happened to any hope of exploration beyond low Earth orbit for NASA for the period of time between 1970, when the Space Transportation System was originally approved, and when we phased out the Shuttle in July of 2011.

We have an opportunity now again to put the triangle back together. If you don't have all three legs, if you don't have a heavy lift launch vehicle and Multipurpose Crew Vehicle, the International Space Station, which is our toehold on the universe today and commercial crew and cargo to get us in and out of low Earth orbit, then you take away a leg and the triangle won't work.

Mr. CULBERSON. Yes, but the heavy-lift rocket, talk to us about that, and the planetary program.

Mr. BOLDEN. The heavy-lift rocket——

Mr. CULBERSON. And you have gotten good support for——

Mr. BOLDEN [continuing]. As I mentioned. We have support for it. If I were king for a day, and I think I've talked to the chairman about this a little bit. Flexibility within the top line would be absolutely superb for us. We are in the development program business. The heavy-lift rocket, the Multi Purpose Crew Vehicle—we have a flat-line budget. I can live with that if we're allowed flexibility inside that flat-line budget.

What that means is we can't have winners and losers. I need to be able to move money in the exploration program when I need a chunk of money for the heavy-lift rocket or construction of a test facility or something. I need to be able to move it there to keep everything going sequentially so that we don't have to stop a manufacturer or an industrial partner. We don't have that flexibility right now.

Mr. CULBERSON. Right. But I know——

Mr. BOLDEN. The top line is good.

Mr. CULBERSON. And that's, in this environment, a blessing.

Mr. BOLDEN. Yes, sir.

Mr. CULBERSON. That's an indication of the support of Congress, the chairman, and Chairman Mikulski for NASA.

Mr. BOLDEN. Yes.

Mr. CULBERSON. Because everybody else is really getting cut. And we admire you, support the agency. So that's a good thing.

Mr. BOLDEN. Yes, sir. I told the chairman I will talk to Congressman Aderholt. Congressman Aderholt, he's going to want me to agree that we should put even more money into the heavy-lift launch vehicle, and I would not agree with that. I'm a person who tries to be honest. I don't need a lot of extra money in the heavy-lift launch vehicle right now.

I do need additional money to shore up commercial crew. Otherwise, that leg of the triangle is going to fall away and we're going to be back to 1970s again, where we had this grand vision of exploration and going to an asteroid and going to Mars and we can't get there because we can't complete the technology development and the understanding of what happens to the human body, the lessons we're learning on the International Space Station right now, because I can't get people to the International Space Station. Because I do not want to pay the Russians beyond 2016.

Mr. CULBERSON. Sure. But, of course, the——

Mr. BOLDEN. And that's what I will have to do.

Mr. CULBERSON. Of course, the law, the money, the funding you see from Congress is an indication of our support for a heavy-lift rocket to get beyond low Earth orbit.

Mr. BOLDEN. Yes, sir.

Mr. CULBERSON. Could you also talk to us—I know my friend, Mr. Schiff, will follow up on this, as well—about the effect—first of all, if you could, very quickly, a time frame on the heavy-lift rocket and Orion.

And then, secondly, the effect of the work the chairman's done with Chairman Mikulski on funding the planetary program and how important that is, both for Mars and for Europa.

Mr. BOLDEN. Yes. The Orion will fly its first flight a little bit more than a year from now. I know that's hard for people to believe, but we have the first test flight on Orion, without an environmental control system. If you want to call it a prototype, it's sort of like a prototype. Very heavily instrumented. It will launch in the fall of 2014. It will buy down a lot of risk on the ultimate vehicle, because it will tell us whether or not that vehicle is appropriate to withstand the intense pressures and temperatures of reentry from places like lunar orbit or Mars or an asteroid. So we need that. It will also help us understand whether it's oversized, undersized, or what, because what you see on Orion today is not the final Orion that we'll have.

The heavy-lift launch vehicle should be available in 2017. Then we'll put Orion with the heavy-lift launch vehicle, fly its first unmanned, uncrewed flight in 2017. Then we should be ready to come back and fly the first manned mission in 2021.

PLANETARY SCIENCE

Our science program—I don't like using the word "robust," because "robust" means you've got a lot of money. Our science program is aggressive and ambitious and highly successful.

I told people yesterday, it's interesting because we were being blasted for how much money had been taken from the planetary program and how we had decimated the Mars program. And yet, today, we have the most sophisticated rover in the history of humanity on the surface of Mars, getting ready to climb a mountain and help us understand the geologic history of that planet, which relates to Earth. It will help us here understand more about our own planet.

Mr. CULBERSON. Sure.

Mr. BOLDEN. Between now and the 2030s, when we take humans, we have Insight, which is a smaller lander that will actually core meters into the Martian surface. That's scheduled for 2016. In fact, MAVEN, which is an atmospheric studies mission, is next year, then Insight in 2016. We are a partner again with the Europeans on their ExoMars program, not to the extent that we wanted to be, because we couldn't afford it. We got criticized when we said we've got to step back for a moment and find out what we can afford. The chairman said, I can't do everything, I agree, so we told the Europeans, We can't provide a launch vehicle. We can't provide this. But we're giving them an orbiting communications package for 2016 and actually contributing to the 2018 lander with our expertise, which keeps work going at the Jet Propulsion Lab, because that's entry, descent, and landing.

Mr. CULBERSON. Sure.

Mr. BOLDEN. So that gives us an opportunity to keep that going. Then in 2020 we have a Curiosity-like rover that we're going to put on the surface of Mars again. Use the same design to save money. The science definition team has already begun their work and will probably come in with a report to us——

Mr. CULBERSON. Sure.

Mr. BOLDEN [continuing]. Late summer, early fall, and we'll know what we're going to do there.

Mr. CULBERSON. And then if I could, in conclusion, very quickly, if you could also comment on the fact—obviously, the committee has protected funding for planetary, thanks to Chairman Wolf and Chairman Mikulski, but also because of the language—I'd also, if I could, ask you to reiterate your commitment to ensuring that NASA will carry out the decadal surveys, plan for a mission to Europa.

Mr. BOLDEN. Congressman Culberson, you always put me in this position. I am trying to carry out the NRC's decadal survey direction that their number-one priority is Mars and a sample return. That's number one. What we're trying to do is make sure that the 2020 lander, that the science definition teams make sure that if we don't bring a sample back then, because we aren't able to reach an agreement with the Congress and the Administration on funding that we will not preclude that lander from being able to be the beginning of a sample return mission. If I can't do that, the science committee of my own advisory committee and the National Research Counsel is going to say, Forget it. If you're not going to do a sample return, then forget about Mars, and let's go to Europa. So we think that we are complying with the direction of the decadal survey right now in really focusing on their number-one priority, which was Mars sample return, and then Europa is the——

Mr. CULBERSON. And you've got the support from the Congress to continue on both those tracks because we don't know yet about——

Mr. BOLDEN. We can't do both.

Mr. CULBERSON [continuing]. The funding——

Mr. BOLDEN. Because of the funding we have, we will continue the work on a Europa mission, as we have briefed you.

Mr. CULBERSON. Uh-huh.

Mr. BOLDEN. We're looking for innovative ways to fly a mission to Europa that is affordable. All estimates that I have been given on a mission to Europa right now are not affordable in our budget or in the foreseeable budget, not if we're flying to Mars. So we cannot do both, but we continue our developmental efforts at a lower level, not a full development program yet, but——

Mr. CULBERSON. Yeah. That's why the Congress has got language in the bill to make sure that——

Mr. BOLDEN. Yes, sir. We are doing that.

Mr. CULBERSON [continuing]. We preserve that ability to do that mission.

Mr. BOLDEN. We continue to do that.

Mr. CULBERSON. Thank you, sir.

Mr. BOLDEN. Yes, sir.

Mr. CULBERSON. Thank you, Mr. Chairman.

Mr. WOLF. Mr. Schiff.

Mr. SCHIFF. Thank you, Mr. Chairman.

And I just want to join my colleague at outset in thanking you, Mr. Chairman, and also Ranking Member Fattah for your strong support of planetary science and the Mars program and Europa,

which are in a far better position now than they started out a year and a half ago and would be nowhere without your good work.

And, Mr. Administrator, it's good to see you.

You know, just—I do want to set the record straight on one thing. We have been very critical of the administration on Mars, not because we don't acknowledge the incredible success of Curiosity, but rather because Curiosity—the development of Curiosity occurred in prior years, and while we're funding the current operation of Curiosity, none of us are content that Curiosity be our last great achievement. So it was very important to us to continue in the tradition of Curiosity with other great planetary science missions. And I'm very grateful that NASA has moved forward with another Curiosity-like mission as part of sample return.

And I share my colleague, Mr. Culberson's deep interest and commitment to Europa, which I think we also think is a fabulous mission and of great scientific interest and something I think we're all committed to. And we need to work on the resources, we need to work on the sequencing and the timing, and we need to work on bringing costs down.

Mr. BOLDEN. Yes, sir.

Mr. SCHIFF. But I think we all have a deep interest in both those missions.

I wanted to ask you about the Mars budget. I understand it's very important to launch in 2020, given the technical challenges and uncertainties surrounding planetary orbits with launching at a later date.

Can you tell us how NASA plans to ensure that adequate resources are devoted to preformulation of the Mars 2020 mission to minimize risk and to enable a successful launch on schedule?

My main concern with respect to the 2020 mission is that I'm concerned that if NASA backloads the funding too much, we'll lose critical expertise that we've gained from developing and launching Curiosity. So if you could address that.

Mr. BOLDEN. Congressman, as we briefed, as we mentioned before in conversation with people, when we brought the 2020 proposal forward, we showed where we could fund 2020 in the 2013 budget and the projection forward for the outyears. It will be tough due to sequestration. That word keeps coming up because that changes everything that we told you. As long as we can manage our funds the way that we are doing currently, then Mars 2020 will be okay. If we have to live under sequestration for the next 10 years, as it is set out, it's a whole new ballgame, because NASA is no longer a $17.7 billion agency, NASA is a $16.8 billion agency.

I don't do magic, I will have to find a way to delete either a billion dollars worth of content or a billion dollars worth of people, and I don't think we want to do the people. So I will have to eliminate a billion dollars worth of content or, as I mentioned to Mr. Culberson, become very innovative in finding new ways, different ways that we can do the projects. What was so great about Mars 2020 is it's a carbon copy of Curiosity, and that's why I'm relatively confident when I tell you that I think we can, we should not have problems with Mars 2020. We have got pieces and parts. We have got all the expertise. The only thing we have to do with Mars 2020 is put the results from the Science Definition Team together and

then determine whether or not we can do all the science that they want to do, but the mission itself, minus whatever the final science turns out to be. As I mentioned before, if it turns out that we can't figure out how to get a Mars sample return, at least the precursor for it on the mission, we are liable to be abandoned by the science community. So that's a challenge.

Mr. SCHIFF. Well, it's certainly my hope that we don't live in a sequestered environment for too long and that we could come together on an agreement that——

Mr. BOLDEN. Yes, sir.

Mr. SCHIFF [continuing]. Makes a more sensible approach to our deficit and debt problem. And we will continue to work with you on making sure that, whether we have a sequester or don't, that we don't so backload the Mars funding that we lose our talent pool at places like JPL.

Mr. BOLDEN. Yes, sir.

Mr. SCHIFF. I want to follow up, too, on my colleague's interest in Europa, and the Senate budget has money for Europa in it. And if you could share with us a little of your thoughts on the early priorities in Europa. Is it in doing some of the scientific analyses to determine how this can be done in a more cost-effective way, is that where you would make an early investment in Europa, or where would you employ those early resources on Europa?

Mr. BOLDEN. Congressman, I will get back to you. I will take it for the record to get you the details of what's being done right now, but as I understand it, we are taking whatever funds we have for Europa, not for science definition, but for the definition of the mission itself. What type of vehicle can we afford that will enable us to get the scientists to the planet, to the moon such that we get good science from it, doing analysis that helps us understand how we get more than a month of life out of the vehicle.

[The information follows:]

EUROPA

The FY 2013 Consolidated and Further Continuing Appropriations Act (P.L. 113–6) stipulates, "*Provided That* $75,000,000 shall be for pre-formulation and/or formulation activities for a mission that meets the science goals outlined for the Jupiter Europa mission in the most recent planetary science decadal survey." Given the harsh radiation environment around Europa, and our current understanding of the technologies needed to carry out this type of mission, NASA could use these FY 2013 funds for a variety of early activities related to a future mission to Europa including:

- Initiating an instrument technology development program to reduce one of the key identified risks for a Europa mission;
- Studying design impacts to spacecraft and concept of operations (launch environment, Europa multiple flyby mission concept propulsion module) and the launch vehicle trade space;
- Studying and testing planetary protection sterilization procedures and their associated impacts to science instruments and spacecraft; and
- Conducting preliminary design work on the planned reconnaissance instrument(s).

NASA's goal for these instrument technology development activities would be to identify key risks and associated risk reduction plan, complete some of those risk reduction activities, and mature the instrument system designs. There are five instruments in the model payload for the Europa multiple flyby mission concept (Ice Penetrating Radar, Shortwave Infrared Spectrometer, Topographical Imager, Mass Spectrometer, and magnetometer), and we expect that the first four will require additional technology development work. NASA would competitively award multiple

proposals for each instrument in order test various radiation mitigation techniques and approaches.

Mr. BOLDEN. Europa is an incredibly hostile environment from a radiation standpoint. We can't go and orbit Europa the way that we would do our own moon or the way that we do Vesta or other things. The vehicle will last a few months, if that long. It's just the radiation environment is too harsh. So we have got to be innovative in finding ways to—some of the concepts involve actually flying around Jupiter, and you don't get as much data as you would normally, but at least you keep the satellite alive, because it minimizes the exposure to the just devastating radiation environment of Europa. That's what I am told. Now, I have already gotten myself in trouble, and I have got science people all over the world who are now saying, who told the NASA administrator that? But that's what I have been told. So I probably shouldn't have told you——

Mr. SCHIFF. Well, I am sure you will be hearing from them and we will as well.

Mr. BOLDEN. Yes, sir.

FLIGHT OPPORTUNITIES PROGRAM

Mr. SCHIFF. One last question, Mr. Administrator. The Flight Opportunities Program is a small program in the Space Technology Mission Directorate that purchases reusable suborbital flights for technology development on commercial vehicles on a fixed-price basis. It's a program that costs very little comparatively but has an outsized impact leveraging private investment in a rapidly growing high-tech industry. NASA doesn't pay to develop the vehicles, which are built with private funds to meet a market, but NASA serves as a key anchor customer. The funding for the Space Technology Mission Directorate did not meet the President's request last year and may not this year as well. How will those reductions impact the Flight Opportunities Program?

Mr. BOLDEN. Mr. Chairman—Congressman Schiff, I will get back to you on the exact implications for the Flight Opportunities Program.

[The information follows:]

FLIGHT OPPORTUNITIES PROGRAM

At this time, the Space Technology Mission Directorate expects to maintain funding equivalent to the FY 2012 level of Flight Opportunities. At this level, the Flight Opportunities Program should be able to support a modest number of funded technologies for development. These technologies will utilize suborbital reusable launch vehicles (sRLV) to validate and demonstrate their technology development objectives. The solicitation has been released and we expect to make selections by the end of fiscal year 2013. In addition, the Program will continue to invest in the commercial suborbital vehicle industry fostering a new, U.S. capability.

Mr. BOLDEN. But as I understand it——

Mr. SCHIFF. And I don't mind you calling me that, but I think Mr. Wolf might.

Mr. BOLDEN. I will get back to you. But as I remember, the programs that the Space Technology Mission Directorate has already notified centers and partners that we won't be able to start, I don't remember Flight Opportunities being one of them. We do have already working with, for example, Virgin Galactic and some other companies that we are going to try to utilize the capability that

they give us. But I will get back to you with the details on any impacts to the Flight Opportunity Program.

Mr. SCHIFF. Thank you, Administrator.

Thank you, Mr. Chairman.

Mr. WOLF. Thank you.

Mr. Bonner.

HEAVY LIFT LAUNCH VEHICLE AND MULTI PURPOSE CREW VEHICLE

Mr. BONNER. Thank you, Mr. Chairman.

Mr. Administrator, good afternoon. It is unfortunate, and we certainly don't blame you for this, but it is unfortunate that as we have had this discussion, a good discussion, that we are doing so in the absence of a budget submission, because it is hard to talk dollars when we don't even know what the administration is going to be bringing to Congress. We are actually debating the budget over on the House floor today, and so there will be several different proposals offered, and hopefully we will come up with a budget in the House. The Senate is committed to doing the same.

I have a question that's consistent with my prior visits with you about NASA's future, but before I go there, I know you had indicated to the chairman and also in a response to Mr. Culberson that you would be talking directly with Mr. Aderholt, but since he is not here today and he is my colleague from Alabama, he asked me to put a few questions on the record.

MULTI-YEAR BUDGET

Mr. BOLDEN. Yes, sir.

Mr. BONNER. You have already talked about some of this, but I want to get his questions on the record for your consideration.

Mr. BOLDEN. Yes, sir.

Mr. BONNER. Many of us believe that the Space Launch System adds an important national capability to our space program as a vehicle able to launch both astronauts and deep space science missions. And it is our understanding that the SLS has met several early milestones, but some of us are concerned that OMB has apparently imposed a multiyear budget of $1.1 billion per year for the rocket development portion of the work. Every rocket development engineering plan has peaks and valleys, so some might say that this flatline budget is artificial.

What do you anticipate your budget doing in both 2014 and 2015 to ensure that SLS receives the modest increases in those 2 years which are necessary in order to continue to stay on schedule and to serve the country's space needs in a timely way? And then I will have a follow-up to that question.

Mr. BOLDEN. Yes, sir. Congressman Bonner, when we reached an agreement, we, the administration with the Congress in 2010 in the Authorization Act, with the insistence actually of Senator Kay Bailey Hutchison that NASA needed to establish what its priorities were, at that time among those priorities were SLS and MPCV, enhancement and expansion of the International Space Station by utilization of a commercial crew and cargo capability, the James Webb Space Telescope. So those were the big three, and we have committed that when we have to take money, we will not go to the big three. If you look at the budget submission for 2013, even when

we have gone through 5 percent cut exercises and everything else, we've blocked those off. I recently added safety and security and export control to that, that we won't effect across-the-board cuts to those areas just like we do everything else.

Again, I hate to keep going back to it, but the one thing that could impact SLS and MPCV but doesn't right now is sequestration. But, again, we're looking at 1 year. It's a 10-year plan. So 10 years of sequestration, if the Congress and the administration are not able to resolve that. Again, I don't want to hype things, because we hype stuff too much, but that could have devastating effects on all of our programs. But right now schedule-wise, we don't see any impact to MPCV. In fact, actually, the vehicle itself will probably be ready before its 2014 launch date, but it's getting time on the range, getting a launch vehicle made available, because we're going to launch it on a Delta IV. So that is a great indication, especially when you consider that MPCV has recovered from a crack during testing, but those kinds of things we expected. That's the peak and valley that you talked about in funding.

In our development program, things can be blowing along just as smoothly as you want, and then all of a sudden something unexpected happens. Unless something unexpected happens, we don't see that we won't make the 2017 launch date for the first flight of MPCV on SLS and then a 2021. I would love to be able to pull the 2021 date forward, but I need to talk with people who are much smarter than I am in the agency to find out whether that is a technical challenge or whether it's a fiscal challenge. The 2017 date is not a technical challenge at all, it's a fiscal challenge—I'm sorry, it's not a fiscal challenge, it's a technical challenge. We just cannot have the vehicle ready before 2017; 2021, I don't know.

Mr. BONNER. Well, you make a compelling argument. I don't think you'd have anyone at this table disagree with you about the impact of sequestration. I hope you've had a chance to convey that message to the President, because, as you know, when we studied history, or civics and how a bill becomes a law, it passes the House, it passes the Senate, we reconcile the two, and it takes the President to enact it. And so sequestration, we all have our hands on that whether we voted for it or not, and the President, the administration has a responsibility as well. But I don't know any person up here, Democrat or Republican, that is celebrating sequestration, and especially if it goes in terms of its longer term.

Follow-up question from Congressman Aderholt would be that based on your response there, it's our understanding that our current biggest rockets would take approximately 7 years, for example, to reach the moons around Jupiter or Saturn. The SLS rocket could carry a larger payload than the recent Mars lander missions and could reach Jupiter or Saturn in roughly 3-1/2 years.

And I think you've already addressed this with Mr. Culberson, but just to make sure it's all on the record. That would seem to some that it would be a good return on the investment. What is NASA doing to encourage coordination and planning between SLS and the planetary science projects?

Mr. BOLDEN. Mr. Bonner, we are finally making headway in helping the science community understand that we are no longer in a stovepiped organization. We are really trying to fuse human

exploration and science, because, again, they're interdependent. What you said, I've heard the same story. I have been told that if we launched a Europa mission to Jupiter today with an Atlas V and then we finished the development of SLS and launch in 2019 or 2017, I guess, it would catch up with and pass the Europa vehicle that we launch today. It's just physics, And if you can get something going really fast, really quick, once it's in space, it doesn't lose speed. The heavy lift launch vehicle, particularly with its upper stage, with a J–2X, we get things going really fast, really quick. And they will——

Mr. FATTAH [presiding]. Is that on a Delta IV?

Mr. BOLDEN. Oh, no, no, no. This is the combination SLS and——

Mr. FATTAH. This is the one that——

Mr. BOLDEN. This is the real SLS and MPCV. I'm going to have the experts come in and brief you all, because I'm giving you concepts. I don't ever claim to give you real numbers, so mine is an anecdotal story about launching today and being caught on the way to Jupiter. But I have heard that over and over and over again. The other thing is it will revolutionize the way that we do interplanetary missions, to be quite honest.

What would be even better would be the type of propulsion that Mike Gazarik and the folks in the Space Technology Mission Directorate are trying to develop, which is game-changing propulsion that cuts the time of transit from here to Mars from 8 months to something less, because the limiting factor for us there is the ability of the human, the central nervous system to sustain 8 months in a hostile radiation environment. The reason we're confused is because we don't know what the effect will be. That's why the International Space Station is so critical, that's why commercial crew and cargo is so critical, because we lose one of those legs of the triangle and we can't finish the race.

Mr. FATTAH. All right. We're going to go to Representative Serrano so that he can get some questions in before the——

Mr. CULBERSON. Sure. And Frank has stepped out to go vote. He will be right back.

Mr. FATTAH. Mr. Serrano.

Mr. SERRANO. Thank you. Administrator Bolden, thank you for being here.

Mr. FATTAH. We have a vote on. The chairman went over to vote. When he comes back, I'm going to go vote and come back.

Mr. CULBERSON. Okay.

Mr. FATTAH. We're going to keep going.

Mr. BOLDEN. Can I go vote?

Mr. FATTAH. Sure.

ARECIBO OBSERVATORY

Mr. SERRANO. But then you have to face the voters and that's—you think this is tough?

Mr. BOLDEN. I like this job.

Mr. SERRANO. This is easy.

Mr. Administrator, throughout the years, the last few years for certain, there were two questions I asked concerning the Commonwealth of Puerto Rico. One always was, do you think there will be

someone from that community, our community that will go up in space as an astronaut. And Joe Acaba did, and he is a superstar now. No one remembers I asked that question a lot of times, so I'd like to take some credit for it. But anyway, I couldn't do what he did, and he's really done a wonderful job of going around talking to schools and other places and it's wonderful. And I understand he's going up again.

And the other one is the Arecibo Observatory, which for a while was in danger of being done away with, and yet there were people in the scientific community who continued to tell us that that's a very important place. And for the commonwealth, for the island, it's not just the work that it does and the service that this observatory brings to our scientific research, but also the fact that it's an icon, if a thing can be an icon, in the community.

What's the future, what is happening, and what can we do? You know how I feel about it, but——

Mr. BOLDEN. Yes, sir. I will just have to kind of go by what I've heard from Dr. John Holdren, who's the President's science advisor and knows much more about Arecibo than I did, but we have been talking about Arecibo, the new telescope that will be in Chile, anything that helps us identify and track Near Earth Objects, and that is a critical need for Arecibo to do that. If you take any telescope out of the mix, we'll still be able to do the kinds of things we're doing, but not as well, because we need lots of data and we need lots of information on asteroids. The question was asked yesterday about its funding, because I think it receives a lot of funding from the National Science Foundation.

Mr. SERRANO. Exactly.

Mr. BOLDEN. Dr. Holdren, I think he actually took an action to go get some information on that. But my understanding is that NSF intends to continue to fund it, but I can't answer that for NSF.

Mr. SERRANO. Right. I understand that. But you should know or remember that this committee has been strongly in the past, under both party leaderships, have been very strong in supporting it.

Quickly, the whole issue of STEM, you know, the lack of engineers, if you will, it can't be that people are not capable of teaching it, so it may be that we don't have folks who are interested. And yet we live in a society where young people are involved in technology day and night. Is there a relationship between the society we have now and going into these fields, and if not, how can we resolve that?

Mr. BOLDEN. The person who could answer that question brilliantly is Joe Acaba. Joe Acaba is a school teacher. He was a middle school math teacher and selected to be an astronaut in a class that NASA made the conscious decision that we wanted to bring people who knew how to teach, who had an education background into the Astronaut Corps, not as payload specialists, not as anything, but as full-term astronauts, and Joe is one of the incredible ones. I think what we have to do, and I think he would tell you the same thing, or if you get a chance to see Suni Williams, who will be here on the Hill tonight for a reception, I think they would tell you we have two challenges. We always talk about inspiration, but you can't inspire a young person if they don't know what's

available. So we've got to inform them of what's available. People like Joe Acaba, Suni Williams, Don Pettit, who is the modern day Mr. Wizard, we have to continue to get them in front of school kids, remotely most of the time, downlink from the International Space Station, visiting a school every once in a while when they can to say, look, I'm no different than you. I started out just like you did.

Mr. SERRANO. Right.

Mr. BOLDEN. You've got to study really hard and work hard, and you can do the same thing I've done.

Mr. SERRANO. Thank you. On a lighter note and in closing, one of the advantages of being bilingual, obviously, is that you see words you recognize. So when I saw Europa for the first time before I did my homework, I realized that that's Spanish for Europe. And I was wondering what the heck were you making such a big fuss—not today, but in the past—about going to Europe. I said you can do that with no sweat. Then I did a little homework and realized that it may be the only moment where speaking Spanish created a little problem for me.

Mr. BOLDEN. Sure.

Mr. SERRANO. Thank you.

Mr. BOLDEN. Thank you very much.

Mr. FATTAH. Thank you. And the chairman's returned, so I'm going to take a few minutes and then I'm going to go vote. But let me—and I'm glad Mr. Culberson is still here because he's my good friend and nobody is more serious about this science business than him, and I am a full supporter of his work on planetary science. But I do want to make sure that we just correct the record a little bit. You said that the administrator didn't mention this, the Space Launch System, in his statement. It is in the first paragraph. I got to make sure that we get the record just, you know.

Mr. CULBERSON. Thank you for——

Mr. FATTAH. I don't want him to think I'm picking on him in his absence.

Mr. CULBERSON. Thank you.

Mr. FATTAH. But this—all of the dollars that you are spending in NASA are to some degree very significantly micromanaged by the Congress. And——

Mr. BOLDEN. You said that, sir.

Mr. FATTAH. I said that.

Mr. BOLDEN. I agree.

Mr. FATTAH. And my friend in his statement said that he was working on some legislation to give you more flexibility. And then in between all that, he went back to saying, well, this is what we want you to do. And this is the problem here, and I want to make sure that we're straightforward——

Mr. BOLDEN. Yes, sir.

Mr. FATTAH [continuing]. And that we all understand each other, and that you are basically doing what the Congress has laid out. So in this launch system deal, the Congress has even spelled out almost to the degree of how much cargo it's got to carry and so on and so on. So this is not—this is policymakers in the Congress kind of laying onto NASA a very specific requirement that then you have to figure out the science and the technical capability of carrying out things that may not—that in some cases might even work

at cross-purposes, like get there as fast as you can, but carry all this stuff with you, or get there as fast as you can, but we want to send humans too. I mean, these things may get a little more challenging.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. And then to constrain the budget on top of that. But I think it's important to note that there was an agreement with the administration that said, okay, we're going to do this long-distance run to Mars, we're going to believe in the American private sector and believe that they can do something that the government's been doing for decades in terms of low Earth orbit, we're going to commercialize that. And we've seen the success of that. That's going to save money in the long-term. And that this was part of a package of agreements——

Mr. BOLDEN. Yes, sir.

Mr. FATTAH [continuing]. That you have been carrying out. And really it was probably more challenging to fly combat missions over enemy territory than deal with some of the challenges up here on the Hill in the various committees that have jurisdiction, because we have funding jurisdiction.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. But there are committees that have authorizing jurisdictions. And then, of course, there's the Holy Grail, there's the U.S. Senate, which is just in charge, right. So these are issues that you have to manage. So I want to thank you for the work that you're doing. I wanted to set the record straight.

Mr. BOLDEN. Yes, sir. Thank you. I appreciate it.

Mr. FATTAH. And while I'm doing that, Mr. Schiff said that Chairman Wolf might be concerned if he was called Chairman. I would be concerned if he was called Chairman since he'd have to get past my chair to get to the chairmanship. So thank you very much.

Mr. BOLDEN. Sir, thank you very much for your very eloquent presentation of the facts.

NASA SPACE ACT AGREEMENTS

Mr. WOLF [presiding]. I thank you. Yeah, I don't care who he calls Chairman, but I understand from your point of view.

The reason I left is so we can keep this going. And when we have the next vote, I think we're going to end, because I don't want you to have to spend the whole day here. So I'm going to go through these relatively fast.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. There's a wealth of information available online and in other public sources, about unclassified Federal contracts, including who has received those contracts, their dollar values and the purposes. As far as I know, there's no comparable source of public information about NASA's Space Act Agreements. Why shouldn't this information be available to public scrutiny?

Mr. BOLDEN. Mr. Chairman, are you asking why shouldn't Space Act Agreement information on classified programs be available for public scrutiny?

Mr. WOLF. No, the unclassified.

Mr. BOLDEN. As a matter of fact, we're working to provide for the Congress and the American public, it would be more like a spreadsheet that would list the Space Act agreements that we have in force. And I actually think——

Mr. WOLF. It was very tough for the committee to get this.

Mr. BOLDEN. I think we provided that to the committee.

Mr. WOLF. Yeah, but I meant for the public, though. Why shouldn't it be available for public scrutiny? It's public money and——

Mr. BOLDEN. Mr. Chairman, I will take it for action.

[The information follows:]

SPACE ACT AGREEMENTS

NASA is prepared to post summary information regarding NASA current domestic and international Space Act Agreements at the level of detail previously provided to the Committee.

Mr. BOLDEN. I thought once we provided it to you, it was in the public domain. I think it's in the public domain anyway. Mr. Chairman, let me go back and find out. I thought once we gave it to you, it's gone.

Mr. WOLF. Well, no, we didn't do that, and you authorized——

Mr. BOLDEN. No, sir. I meant once we provide it to you, then it is no longer privileged information between the administration and the Congress. Unless we put something on it that says Sensitive But Unclassified (SBU)? If I put an SBU on it, it means that one of the companies has asked us not to divulge some technical information because it's proprietary, but we very seldom have that. I think I sent you something recently on the security issue, but usually when we send it over in a regular document, you can have it and you can put it up——

Mr. WOLF. Well, I think the authorizers——

Mr. BOLDEN. We'll put it up on a Website.

Mr. WOLF. I think the authorizers had a problem.

NASA's process for entering into Space Act Agreements is extremely decentralized. The individual centers control much of the process and even have authority to enter into some agreements without headquarters notification or review.

How do you ensure consistency in the application of standards and controls when the centers have so much autonomy? And shouldn't it be centralized? Shouldn't you have the final sign-off?

Mr. BOLDEN. No, sir. I don't. I shouldn't if we want to get things done. The purpose of a Space Act agreement, as I understand it, as directed by the Congress, is to enhance the transfer of technology, enhance NASA's ability to help grow the economy and make us stronger. If everything's got to come to headquarters, we're in trouble. We slow things down. We try not to.

Major Space Act agreements that involve utilization of big facilities or something that may have dual use for a national security need or something, I probably need to be involved, but, there are some things that the centers do where we have asked them to find ways to better, more efficiently utilize their facilities that we know we're going to need down the road, there's no reason to excess it, but we're not using it.

Mr. WOLF. Okay. Well——

Mr. BOLDEN. An example would be the Johnson Space Center with the Neutral Buoyancy Lab, the NBL. We are still training astronauts to do space walks, but there's a lot of free time in there, and so they now work to enter into Space Act agreements. They're almost always reimbursable, where the company pays for the utilization of a facility.

Mr. WOLF. Maybe they should all be made public, then, because the committee had a hard time——

Mr. BOLDEN. That is what I thought——

Mr. WOLF. The committee had a hard time and the authorizers had a hard time.

Mr. BOLDEN. I will get back to you.

Mr. WOLF. Okay.

Mr. BOLDEN. But we talked about what I think you're telling me. I agree with you that Space Act agreements should be available in the public domain somehow, whether it's online or something. We actually talked about this the other day, because in the small business realm, anybody can go on the NASA Website, go to the small business drop-down and they can see every single small business contract that NASA has, whether it's at a center or anywhere, and when that's going to expire and what it is so they can they can plan ahead as to whether or not they want to bid on it. We won't have anything like that with a Space Act Agreement, because Space Acts are generally unique to the—a person——

Mr. WOLF. Right.

Mr. BOLDEN. But I'll get back to you, sir. I think we can do this easy.

Mr. WOLF. Okay. My understanding is that Space Act agreements with foreign entities are reviewed by the State Department when those agreements are considered significant and are intended to be binding under international law.

Does that mean that some foreign Space Act Agreements, such as those, quote, not deemed significant, do not receive State Department review?

Mr. BOLDEN. Sir, I will verify what I'm about to say.

My understanding, since everything I do with an international is considered a treaty, something that I treat very seriously, and I include Space Act Agreements, I think anything that we do with a foreign entity, any agreement that we make with them goes through the—I can't remember what the number of the process is, but it goes through the State Department review process. We have an example of a Space Act Agreement that's waiting to be signed now and considered to be small and insignificant, but it went through State Department review. Frequently they go through the entire interagency process to make sure that we're not stepping on DOD's toes or anything else.

Mr. WOLF. If you can share that with the committee.

Mr. BOLDEN. But I will get back to you on that, yes, sir.

[The information follows:]

SPACE ACT AGREEMENTS

NASA agreements with foreign entities under international law must be procedurally consistent with the Case-Zablocki Act, (1 U.S.C. § 112(b)), and its implementing regulations, (22 C.F.R. § 181). Before negotiating and executing an agreement under international law, NASA submits the draft agreement to the State De-

partment Bureau of Oceans and International Environmental and Scientific Affairs, which coordinates with the State Department's Office of the Legal Adviser to determine whether the "Circular 175 process," as described in 22 C.F.R. § 181, is a required step prior to the negotiation of the agreement. If the C–175 process is required, the State Department and other agencies review the draft agreement and may provide comments. Such comments are typically incorporated before NASA is given authorization to negotiate and conclude the agreement.

For NASA agreements with foreign entities concluded under U.S. Federal law, NASA advises State about such agreements when they are sensitive, e.g. for foreign policy reasons, and seeks the State Department's views.

COST AND SCHEDULE CONTROL

Mr. WOLF. Cost control. GAO recently found evidence of improvements in NASA's adherence to cost and schedule goals among all current projects other than James Webb. To what do you attribute this improvement, and do you believe it's sustainable?

Mr. BOLDEN. Mr. Chairman, I disagree with that statement. That statement is not accurate in its entirety. The James Webb Space Telescope for the last 2 years has been under control both in schedule and cost. In fact, they're a little bit ahead in schedule. I'm not certain what is meant by other than the James Webb Space Telescope. We have instituted processes like joint confidence level——

Mr. WOLF. Well, it was actually a congratulatory, complimentary question.

Mr. BOLDEN. I know it's intended to be, sir, but it's not a compliment——

Mr. WOLF. I know GAO is looking at——

Mr. BOLDEN. Yes, sir. It is not a complimentary comment about the James Webb Space Telescope. That is a very, very complex project that is going to revolutionize everything.

Mr. WOLF. I understand. That's why we on the committee support it.

Mr. BOLDEN. We all work very hard, and I promised you and Senator Mikulski that we were going to get that program in order. It has new management. Northrop Grumman put new management in place. We submitted a revised cost and schedule profile, and we're living up to that. So when somebody says other than James Webb, I just have to say, what do you mean it's not living up to what it was supposed to do.

Mr. WOLF. Well, I'll give you the telephone number of the people——

Mr. BOLDEN. Yes, sir.

Mr. WOLF [continuing]. That wrote the question and we can talk about it.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. Last year NASA requested a significant budget increase for the James Webb program despite the fact that it is literally billions of dollars over budget. At the same time, NASA cancelled the GEMS astrophysics project because it was at risk of going over budget by $45 million or $50 million. I think this highlights a significant difference in the way that large and small projects are treated by NASA, with the larger, riskier, more expensive projects being given more flexibility on cost and schedule issues than smaller projects. Do you agree?

Mr. BOLDEN. I understand the question now. It's sort of like is James Webb too big to fail? That's not the case. I made a promise to this Congress, both House and Senate, that we would keep James Webb on cost and on schedule, and if it violated that, there is a limit beyond which it will not go.

Mr. WOLF. But we really can't cancel James Webb. I mean, it would be tough to cancel James Webb now. It would be——

Mr. BOLDEN. For me? If something went wrong with James Webb that caused it right now to have a dramatic change in meeting its cost or schedule—that means we have met a significant technical challenge that we didn't anticipate. So it may be something that evaluation says we cannot possibly overcome. So nothing's too big to fail. I would not waste the taxpayers' money if I found out that there was something unknown. This is like the 1,000-year asteroid hitting Earth that I tell you don't worry about.

If we reach a point where James Webb begins to overrun again and it gets significantly over or it gets significantly delayed, it means we have met a technical challenge that we did not anticipate, and that would be something that we would have to evaluate and say, is this worth trying to salvage? I don't anticipate that. I don't want to panic anybody. I don't anticipate that happening.

Mr. WOLF. The press, they're all writing back there.

Mr. BOLDEN. Yes, sir. Well, they need to understand what I'm—I know they like to write that stuff, but I'm not talking doom and gloom. I'm saying James Webb is an incredible story. I have 2 years now of data that says the program has been on cost and on schedule and we're buying down risk all the time. So if something changes, it means we've had something happen that we really didn't anticipate.

Mr. WOLF. Okay.

Mr. BOLDEN. And that's always possible in a development program.

Mr. WOLF. Sure. I understand.

Mr. BOLDEN. GEMS, the other example, GEMS had a very defined cost ceiling. It's a small project. So I don't put that in the same category as the James Webb Space Telescope. GEMS was not something that was going to have a dramatic impact on humanity. It was a very good project, but technically it had some challenges that we just figured it cannot overcome those technical challenges within the funding guidelines that we agreed. I didn't make the call, but was a good call and I thought it was a pretty easy call.

Mr. WOLF. Okay.

Mr. BOLDEN. Yeah.

SEQUESTRATION IMPLEMENTATION

Mr. WOLF. Fiscal year 2013 funding implementation. In discussions following the submission of the Sequestration Transparency Act report, NASA told us that it would apply sequestration equally to each appropriated amount, but not necessarily to each program and project contained within those amounts. That approach looks inconsistent, however, with the statutory requirement to apply sequestration to each program, project, and activity. How does your sequestration implementation plan address the statutory requirement?

Mr. BOLDEN. I think we're in compliance with the statutory requirement to apply the 5 percent cut across the board in each directorate or program. I'm not going to guess what they're talking about, but I don't—I think we are complying with the statutory requirement reference to sequestration. If I can get an example of something——

Mr. WOLF. Yeah. Basically the next question is that you could be using this to go after—and let me ask the question—some congressional priorities that we were talking about earlier.

Mr. BOLDEN. Oh.

Mr. WOLF. So can Congress and the Administration have different views about the appropriate funding levels for several major NASA programs, including planetary science, Orion, SLS? Can you assure the committee that the Administration will not use sequestration as an opportunity to implement selected cuts to congressional priorities? How will you incorporate congressional input into your decision making about where and when to reallocate funds as a result of sequestration? So that's the——

Mr. BOLDEN. Yes, sir, because maybe I'm naive. I don't view anything as a congressional priority or an administration priority. When the Authorization Act was signed by the President in 2010, that established what I mentioned were three big priorities. It's actually more than three, but I lump the International Space Station, commercial crew and cargo, and technology development together.

So I think in that particular time, we agreed that those five things were priorities for the Agency. What we have done is we've tried to wall them off such that whenever a cut had to come, whenever the administration asked me for a 5 percent cut or a 2 percent cut, I don't go and look at SLS or MPCV or commercial crew or the International Space Station. It has to come from somewhere else.

Now, purists, people in the science community will say, yeah, but you're putting programs at jeopardy because you won't take a cut from James Webb. Well, James Webb is a joint national priority established by the FY 2010 Authorization Act. So they're absolutely right. I am not going to go in and take money from James Webb to make something else whole, because I promised the President, and the Congress made an agreement that we would not do that, and so we're not doing that.

WEATHER SATELLITES

Mr. WOLF. Weather satellites. Although NOAA is responsible for the procurement and operation of the Nation's civil weather satellites, they pay NASA on a reimbursable basis to manage the design and development of these satellites through a Joint Agency Satellite Division.

Do you believe this basic division of funding and responsibility between the two agencies is successful? And as you know, the Senate had language in——

Mr. BOLDEN. Yes, sir.

Mr. WOLF [continuing]. That they pretty much took from NOAA and——

Mr. BOLDEN. I understand. The answer to the question, I think it is highly successful, as demonstrated by almost everything that we have managed for NOAA, whether it's GOES or whether it's

NPP or JPSS. We're always challenged financially. I think the arrangement that we have with NOAA—and I'll take this opportunity to compliment the former NOAA administrator, Dr. Jane Lubchenco. She was awesome to work with.

Mr. WOLF. She's gone.

Mr. BOLDEN. She's now gone back to academia, but it was great to have a fellow administrator pick up the phone and say, hey, there's some confusion, we're not in sync. We still are able to do that, because we attend each other's programmatic reviews, we, in the case of a lot of the weather satellites, the JPSS program, we sometimes co-chair each other's reviews so that we make sure that we stay in sync.

Mr. WOLF. Now there's no one home at Commerce. They have no secretary, the acting secretary is leaving, they have no Census Bureau director, they have no PTO director, they have no NOAA administrator. I mean, they have—really it's like the boy in the movie "Home Alone." Remember that movie?

Mr. BOLDEN. Yes, sir, I do.

Mr. WOLF. There's no one over there.

Mr. BOLDEN. "Home Alone 2," also.

Mr. WOLF. I didn't see that one.

Mr. BOLDEN. I really liked it. It was good. I forget which one's Christmas.

Mr. WOLF. I think 1 was Christmas.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. But, okay, do you want to comment?

Mr. BOLDEN. About the Senate's——

Mr. WOLF. About the Senate language. Did you like that or dislike that?

Mr. BOLDEN. I haven't had a chance to sit down face to face with Senator Mikulski, but if the Senate decides and you all agree that we should take weather satellites, we will do that and we'll do a great job.

The point that everyone should understand is the coordination that goes on right now in terms of getting that satellite or that system turned over to NOAA for the operational phase will not change. They are the weather people and the Weather Service, and they do an incredible job.

Mr. WOLF. But would there be savings if you—because, in essence, one becomes a little bit of a middleman. Would there be savings?

Mr. BOLDEN. Congressman, if that were the direction of the Congress that NASA take acquisition of weather satellites from NOAA, and we take it all the way through development and delivery, we would do that. I'm a middle of the road guy. I do what you all tell me to do. But I would make it very clear to people that I think it would be a mistake for NASA to try to take on the job of becoming the Weather Service. We don't do that. We could learn, but we don't do that.

My concern about any movement of responsibility from one agency to the other is who defines the requirements for the new system. If NOAA is defining the requirements and I'm responsible for developing it, we're probably going to have a problem. So I would like to have very clear lines of distinction. If a decision is made to

change the way we do business today, it would just require us to get together with NOAA and all of you in the Congress and at least understand how you want us to implement this change. We can make anything happen. I'm not lobbying for anything.

EXCESS PROPERTY

Mr. WOLF. Excess property. Two weeks ago NASA released a notice of intent to have an external party lease renovate and reuse Hangar One and potentially the rest of Moffett Airfield at the Ames Research Center. It's become a little controversial. Both of these properties have previously been identified as having no current or future NASA purpose. So why is it acceptable to lease them instead of reporting them as excess?

Mr. BOLDEN. Mr. Chairman, what I did was, after years of deliberation and trying to reach an agreement, I asked the GSA, the government's landlord, if they would come in and take over the evaluation of this process for us and run it. I was advised by GSA that the most expeditious way to get NASA out of the business of running an airfield and paying all of its costs is to let them go out and see if there is a private entity or another government entity that would be willing to take that responsibility off our hands. It is a multiyear process to excess something, and so I did not want to have to wait for that multiyear process and continue to pay for something that I'm not using right now.

So, GSA recommended that we go through, what is called a notice of intent to let everybody in the communities know what it is we want to do, that we want to open the book and say anybody who wants to use this facility and for something that we can relate to stuff that NASA does, and in the process wants to resize the hangar because it is such a historical landmark to the community out there, we'll offer it. Then I will go out and meet with the community, tell them how we intend to effect this process, and tell them that, as a taxpayer, they're going to actually benefit, because NASA will no longer be paying for the operation of the airfield or for the maintenance of the hangar or other things. So that's the way that I was able to do that.

Mr. WOLF. There was some controversy, and I gave the IG a letter with regard to that.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. And I don't know if he shared it with you.

Mr. BOLDEN. Mr. Chairman, as you know, if you're talking about land and facilities, there is always controversy. I am almost there. I'm glad that Mr. Culberson came back. I am so close to having the Arc-Jet facility from the Johnson Space Center delivered to the Ames Research Center, because that's where it should be as we look for more efficient, effective ways to do our job. I just wanted to make sure that he was here when I said that in case he wants to shoot me.

Mr. WOLF. Make sure the spies are not involved out there, though, with it.

Mr. BOLDEN. Yes, sir. I got you.

Mr. WOLF. There are some questions on the Space Launch System and Orion that I think you covered. We will submit them for the record.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. I'm going to come back to you if you have some more.

Mr. CULBERSON. Thank you.

COMMERCIAL CREW

Mr. WOLF. Commercial crew. NASA's current round of commercial crew development is being executed via Space Act Agreements, with the base period lasting through the middle of next fiscal year and optional milestones leading all the way to a crewed flight demonstration.

Is it still NASA's intention to award FAR-based contracts for development and certification work beyond the base period?

Mr. BOLDEN. Yes, sir, it is. In fact, we have actually already entered the FAR process—we have a contract, and it just so happens we were very lucky that the three companies that are the Space Act Agreement companies in developing the capability to take crews to orbit are the three companies that also now are bidding for the contract to put together a plan that will show us how they intend to meet our requirements, that will give us all of their hazard reports. And so each of them is now working under contract to do that.

That buys down the risk that we—because I extended the period of utilization of Space Act Agreements. This is not what we were supposed to originally do. You were very gracious and the committee was very gracious in allowing us to keep three competitors when you really wanted to go down to one. So I'm appreciative of that. But we have to have a competition where we go down to one and a half or two or whatever.

Mr. WOLF. When do you see it going to two?

Mr. BOLDEN. When do I see us going to two? We intend to put a request for proposal on the street this summer and you will probably get a down select, and that will either be to two or to one or to one and a half. It is budget dependent.

Mr. WOLF. By the end of this year, then?

Mr. BOLDEN. You won't see the selection announced before the middle of next year, 2014. That's what we see it. That's when we get to phase two. I'll go back and double-check, but I think that's right. I didn't see your staff frown, so I think that's right.

Mr. WOLF. In previous conversations about the program's outyear funding needs, and you referenced it earlier, NASA has indicated that an appropriation of more than $800 million annually will be necessary.

Given the overarching funding constraints that the Congress is likely to be operating under and the need to make continued investments in other high priority programs, like James Webb, Orion, SLS, it seems improbable that the program's budget can be increased. Can the program achieve its goals with an annual funding rate closer to the currently authorized level?

Mr. BOLDEN. Mr. Chairman, it can achieve part of its goals. Its goal to facilitate the success of a commercial space capability to get astronauts to the International Space Station can be achieved if that's what the Congress decides to do. The goal of flying in 2017 cannot be met at a funding level of $500 million. That is consistent with what we've said since I've been the NASA administrator.

It's really hard to go from an estimate of a billion dollars a year for developing a program down to 300, then 400, and then up to 500. We have managed to hold the line on 2017, but if we aren't able to get up to the $800 million level, then I will have to come back and officially notify the Congress that we cannot make 2017 for availability of commercial crew, and that puts the triangle in jeopardy.

Mr. WOLF. Okay.

Let me go to Mr. Culberson.

ARC-JET FACILITY

Mr. CULBERSON. Thank you. Thank you, Mr. Chairman.

Thank you for bringing up the Arc-Jet. That's, of course, a real concern in Houston. The Arc-Jet facility at Johnson was supported by the fees paid by the users, and they had reimbursement contracts, so the cost was near zero, obviously, and had NASA personnel working on it. But the facility——

Mr. BOLDEN. That's not zero, sir.

Mr. CULBERSON. It's a lot less expensive than the Ames facility, which I understood was funded—NASA funded up to 45 percent of the cost to that facility. Now, you've already moved the Arc-Jet components?

Mr. BOLDEN. We are trying to finalize the arrangements for the transfer of the Arc-Jet facility. We are still negotiating, we're still trying to reach consensus, I guess is the right word, with the Congress that every time we get another question that says don't do anything until we get this question answered, that is the right thing to do, and it is something I intend to do, and, if it's the last thing I do as the NASA administrator, which it may be.

We cannot continue to have duplicate facilities. I fully understand what the people at Johnson Space Center say. They like doing that. They're really good at it. We don't need two Arc-Jet facilities.

Mr. CULBERSON. Right. But that one was supported by fees paid by the users.

Mr. BOLDEN. Congressman, I can get back to you on a comparative cost for maintaining two Arc-Jet facilities even when one is at Johnson Space Center and then show you what it would cost to have it out at Ames Research Center, one facility.

[The information follows:]

Arc Jet Facility

As I have previously relayed, NASA's decision to consolidate Agency arc jet capabilities at one location is based on recommendations of internal studies that considered the condition of the equipment and infrastructure that comprise and support the existing, aging facilities at Johnson Space Center (JSC) and the Ames Research Center (ARC). With an assessed 5-year window of sustained, safe operations, the Arc Jet Evaluation Working Group (AJEWG) concluded in 2010 that NASA's arc jet ground test capability is a critical and strategic requirement for NASA to achieve its mission. The AJEWG also concluded that these requirements for arc jet testing can be consolidated into one location having multiple test capabilities. Under current and anticipated future budget constraints, NASA simply cannot fiscally continue to operate and maintain two separate arc jet facilities, particularly given the significant need for strategic repair and infrastructure upgrades at both facilities. As such, in early 2011, NASA made the decision to consolidate and concentrate available sustainment funds to one facility, at ARC.

Ames was selected as the arc jet consolidation site because it has the current infrastructure and growth potential to support NASA's arc jet testing requirements into the future. Projected requirements for future planetary science and crewed mission destinations will require increased performance from arc jet infrastructure. Higher temperatures are needed to simulate the conditions associated with atmospheric entry at destinations such as Mars and near-earth asteroids, as well as for re-entry to Earth for missions of this scope. The underlying infrastructure at ARC is designed to support very high power (up to 150 MW) operations. External studies conducted for NASA have shown that the most cost- and time-efficient approach to meeting upgraded arc jet performance requirements is to install upgraded equipment within the Ames infrastructure. Further, actual operations costs at ARC on a per-test productivity bases are lower than JSC's and are comparable to those of other commercial and DoD arc jet facilities. As I've also previously noted, NASA studies have concluded that modifying the JSC infrastructure so that it is physically capable of matching the technical capability already operating at ARC would require hundreds of millions of dollars in new infrastructure investment – an effort equivalent to building a new facility.

We should note that direct comparisons of data related to cost versus utility of the ARC and JSC arc jet facilities are difficult to establish with certainty, given the differences between the two facilities in terms of existing capabilities, power capacity, and operating protocols. However, the AJEWG study, completed in 2010, cited the annual operating cost for the ARC arc jet facility at $16.1M (at 100 percent utilization). The annual average number of tests for ARC was 989 with an average cost per test of $16,279 per test. The study cited the annual operating cost for JSC at $6.2M, also at 100 percent utilization. The annual average number of tests for JSC was 192 with an average cost per test of $32,292 per test. The planned consolidation of the two arc jet facilities stands to provide a savings of over $110M in fixed JSC operating costs over a 30-year life expectancy.

Given projected efficiencies such as this, my commitment to proceed with efforts to consolidate NASA arc jet capabilities at ARC remains constant, as does my intent to continue to seek further opportunities to address NASA's well-documented challenges with its infrastructure profile.

Mr. CULBERSON. Okay.

Mr. BOLDEN. And I think you'll find that there is a savings.

Mr. CULBERSON. Okay. I would be interested in seeing it.

Mr. BOLDEN. The folk at Johnson Space Center, we have other programs and projects for which we need the bodies. If the body is maintaining an Arc-Jet facility that I could transfer out to the Ames Research Center and get it done, then there are more things that we can do at Johnson that they would really like to do.

Mr. CULBERSON. And obviously all of us on the committee support making best use of our taxpayers' hard-earned dollars.

Mr. BOLDEN. Yes, sir.

Mr. CULBERSON. And I look forward to seeing the analysis.

Mr. BOLDEN. We'll get that.

DESTINATION OF RETIRED ORBITERS

Mr. CULBERSON. And it's hard not to be a little skeptical as a Texan when the Obama administration—I know that wasn't necessarily you—but the Obama administration would not send one of the space shuttles to Houston, Texas, the Johnson Space Center, the home of the manned space program, and sends it instead to New York City or California. I mean, that's deeply offensive. And there's a pattern of behavior, it's not you, sir, I'm not picking on you necessarily.

Mr. BOLDEN. No, no.

Mr. CULBERSON. But let me tell you, there's a pattern with the Obama administration, we vote wrong, and all sorts of things get moved out of Texas.

Mr. BOLDEN. Mr. Culberson, I am a person, I think the chairman will tell you, I want to make sure that everybody understands who's responsible for what. The President didn't have a clue where shuttles were going until I delivered the word that I'm going to have a press conference and we're going to announce this. He didn't—he did not intervene in that. That was my decision. I'm criticized for it, and I appreciate that. I am a Houstonian by adoption.

Mr. CULBERSON. Sure.

Mr. BOLDEN. We had a process, and in that process the city of Houston did not come out one, two, or three, and we can review that with you again. I would like to put that to bed, to be perfectly honest.

Mr. CULBERSON. Sure. I do, too. And I know—and the chairman knows this from my history. I really do my best not to be parochial, you know, because the space program is a strategic asset to the entire country. And I've also always done my best not to look at it as a jobs program, because it's for the good of the entire Nation. And I've always felt and have told all my friends in the space program in Houston that it's always better if we don't think of the space program as a jobs program; look at it from the perspective of the country as a strategic asset, as a way to protect the high ground, as a way to preserve our innovation, our ability as a Nation to innovate and pursue scientific excellence and lift up the human heart. All those things are vitally important—and, oh, by the way, it's a great job program. But I'm with you.

But let me tell you, it is a sensitive subject in Texas. It does cause a lot of hurt. And then when something like the Arc-Jet gets moved out, it just adds to it.

Mr. BOLDEN. Congressman, one thing I would say is there is no threat to the Johnson Space Center by seeking efficiencies. As you said, JSC is the home of human space flight, and mission control is there. That's not going to change, at least not in the foreseeable future. I mean, if you mandated that I have to reduce centers, you told me that you were going to institute a NASA BRAC, then everything's on the table.

Mr. CULBERSON. Sure.

Mr. BOLDEN. But we're not doing that right now.

WORKING WITH A FLAT FUNDING PROFILE

Mr. CULBERSON. Talk to us a little bit about, if I could, the effect of—because we are in a really tough budget environment, looking out forward here, and obviously you have the support of this committee and the Senate committee. Chairman Wolf has been just—there's no one fought harder to protect NASA or the sciences than the chairman, and Senator Mikulski's been terrific.

In a flat funding environment for the future—because we really didn't get a chance to tie this up on the Heavy Lift Launch rocket system and Orion—what does that flat funding profile for the future mean for the—NASA's ability to get a heavy-lift rocket and the Orion capsule operational?

Mr. BOLDEN. As I mentioned before, for the foreseeable future, unless sequestration goes for 10 years, we have planned the priority programs, the SLS, MPCV, International Space Station, commercial crew and technology development, along with the James Webb Space Telescope to fit a flat funding profile.

What I would love to be allowed to do inside that flat funding profile is give the teams the opportunity to move funds around as they need to keep the phasing of availability of things going. An example would be, because we are under a flat funding profile and there was more money than we needed for the development of MPCV, MPCV will probably be ready before it's ready to fly, because we had to spend money when we had it. It's a little bit ahead even in spite of the fact that we had a crack and we had to deal with that.

But there is a launch schedule, a launch availability due to everybody else using Cape Canaveral and we're using a Delta IV. So the availability of the launch vehicle and the pad, if we had had flexibility, we could have shifted the funding from MPCV maybe to construction of the B–2 Test Stand to facilitate the SLS staying on schedule. That's all I'm talking about when I talk about——

Mr. CULBERSON. Okay.

Mr. BOLDEN [continuing]. Funding flexibility inside the programs. We're not talking about taking money from a program.

The calculus is, in the end, the area under the curve will be the same. We will spend the same amount of money on SLS, the same amount of money on MPCV. It's just that we are phasing it such that we deliver things when they're needed, not when the money's available. That's not an efficient way to do things.

Mr. CULBERSON. So you anticipate that the heavy-lift launch rocket will be available to—you'll do your first test flight and then have it available to launch operational when?

Mr. BOLDEN. It will be available for the first flight in 2017.

Mr. CULBERSON. Test.

Mr. BOLDEN. For its first test.

Mr. CULBERSON. Right.

Mr. BOLDEN. That was a technical constraint. You could have given me tons of money. I just don't think we could have accelerated that 2017 date. The human flight will be 2021 or so. That's if we're allowed to be flexible, we——

Mr. CULBERSON. Right.

Mr. BOLDEN [continuing]. We might be able to do so. I don't know.

Mr. CULBERSON. It's a spectacular vehicle for the Europa mission. And I'm going to give you this——

Mr. BOLDEN. It is. We talked about that earlier.

Mr. CULBERSON. And I'm going to give you this. This is why Europa is so important, in one graphic. It's got 40 percent more water than the Earth.

Mr. BOLDEN. Yes, sir.

Mr. CULBERSON. Heat. It's probably saltwater. And it's been oxygenated for billions of years. Almost certainly that's where we're going to discover life. That's why it's been such a top priority of the decadal survey.

Thank you, Mr. Chairman.

Thank you, Administrator Bolden.

CONCLUDING THOUGHTS ON COOPERATION WITH CHINA

Mr. WOLF. We're going to kind of end because I think we're coming up to another vote. Just to wrap up, based on the June, 2012 letter, in less than a year you went from 156 Chinese nationals to 192. If you would furnish the committee what centers they are in.

Mr. BOLDEN. Yes, sir, we'll do that. And, in fact—I will do that, sir. I think in the packet that we delivered we break it down by center. But I will go back and verify that.

[The information follows:]

Material in response to this question was provided previously to the Subcommittee and designated as Sensitive But Unclassified (SBU) information and not for public release.

INSPECTOR GENERAL (IG)

Mr. WOLF. Okay.

Mr. BOLDEN. And we just delivered that last night.

Mr. WOLF. Okay. Firstly, and I want to make this very clear, part of your problem at NASA, I believe, was the IG's office. And if the IG can't do a better job, NASA ought to get a different IG. This is a real test.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. Because the IG sort of blew these things off. In the Ames case, the IG gets an F, he's failed. And in the Langley case, he gets an F. He's failed. Because we talked to career people. They went in to the IG. So this is a test, and you might tell the IG this, or he will probably hear it. If this doesn't work out, this is really

a failure of the Inspector General to do his job or the Inspector General's staff to do their jobs. It is reflected upon you and in some respects the IG. So this is a test. And if the test is not passed—we're going to ask for a new IG there because we're going to make sure.

COOPERATION WITH CHINA

Secondly, Mr. Administrator, you have heard me talk about China. In China today, there are roughly 25—the number flexes up and down—Catholic bishops that are under house arrest. Congressman Chris Smith took holy communion from Bishop Su. Chris led the delegation in Rome for the new Pope, Francis. And that bishop who gave holy communion to Chris Smith has never been seen since. He's been taken away. The Bishop of Hong Kong was by to see me, telling me about the persecution of the Catholic Church. After the Pope was appointed, the Chinese government just said pretty tough things with regard to the Catholic Church, within the last 2 weeks.

Thirdly, there are several hundred Protestant pastors that are in jail, house church people that are in jail. More Chinese people come through my office than probably any other office up here on Capitol Hill. All of the dissidents. The Chinese people are wonderful people. The blind activist, Chen, who is up at NYU, was by to see me a week and a half ago. We're having a hearing with Chen in 2 to 2½ weeks. All the dissidents come through my office. They are wonderful people. They want freedom.

There have been 101 Tibetan monks that have set themselves on fire. They poured kerosene and gasoline on themselves, set themselves on fire and have died by the hands of the Chinese government. We know that they are spying. They run the program whereby they are selling organs, kidneys for well over $50,000, to people that come from the West.

I was in Beijing Prison Number One, where they have Tiananmen Square demonstrators—you remember Tiananmen Square. It was the People's Liberation Army—the same people that run the space program—that fired on the crowd and killed all the people in Tiananmen. When I was in Beijing Prison Number One, we saw Tiananmen Square demonstrators who were making socks for export to the West. They were still in prison in the late 1990s.

Just so you have a better understanding, I'd like some time when the blind activist Chen comes into town, and Bob Fu, the leading dissident, somebody from the Cardinal Kung Foundation of the Catholic Church, somebody who worked for the Dalai Lama, to really come over and take a half an hour and sit down with you so that you understand. We did this with Secretary Gutierrez in the previous administration. So can I get agreement that you'll sit down with these people so they can understand——

Mr. BOLDEN. Mr. Chairman, I would be glad to sit down with them. I would only ask one thing, and that is that I be allowed to ask them——

Mr. WOLF. You can ask them any question you want.

Mr. BOLDEN [continuing]. What they feel our inability to——

Mr. WOLF. You can ask them anything.

Mr. BOLDEN [continuing]. Help with their space program.

Mr. WOLF. You can ask them anything.
Mr. BOLDEN. I mean, that would be fair.
Mr. WOLF. Yeah. Keep in mind——
Mr. BOLDEN. And I would be more than happy.
Mr. WOLF. I guarantee you.
Mr. BOLDEN. Yes, sir.
Mr. WOLF. And I'll come over with them.
Mr. BOLDEN. You and I have a healthy—we respectfully disagree on this, and I think that's good. I applaud you for your devotion to human rights, and I am—I equally—I agree. I just——
Mr. WOLF. I will.
Mr. BOLDEN. Like we said, I grew up saying, you keep your friends close and your enemies closer.
Mr. WOLF. But not to have 192 so close that they can spy.
Mr. BOLDEN. Yes, sir.

COMMERICAL CREW

Mr. WOLF. So, okay, I will arrange for them to come over and see you.
Then the last question was, if we're having these budgetary problems on commercial crew, why have two partners rather than one——
Mr. BOLDEN. Mr. Chairman, that was what I meant. When I said when we get to the down select, I think it would be unfortunate if we ended up with one because then we're in the situation that if that one goes, we're back to the Russians again. But if the budget only supports one when we go into the competition phase, that's what we're going to go with. I would not like to extend the period of Space Act Agreements again. That's the one thing that I——
Mr. WOLF. Right. No, I understand. But the numbers in the House bill were higher than the Senate bill.
Mr. BOLDEN. Yes, sir.
Mr. WOLF. And so I think you have to factor that in, if it comes to that. And so——
Mr. BOLDEN. And, sir, I did not say we could not accomplish the goal of commercial space flight. I said that the goal of flying in 2017 cannot be met at a level of $525 million.
Mr. WOLF. No, I understand. No, you were very clear.
I'm going to go to Mr. Culberson for a second. The last thing is that I do appreciate your accepting those other recommendations at the outset, and if you could let us know when you make the decision on that independent review, I would appreciate it.

CONCLUDING THOUGHTS ON COOPERATION WITH CHINA

With that, I'll go for Mr. Culberson.
Mr. CULBERSON. I just want to very briefly, Mr. Chairman and Administrator Bolden, because other committee members had conflicts and couldn't be here, but Chairman Wolf has the united support of the entire subcommittee, and, frankly, the Congress, in the language that he's included in the bill on China.
Mr. BOLDEN. Yes, sir.
Mr. CULBERSON. And his work to prevent NASA from cooperating with the Chinese space agency. We are—everyone in Congress—Frank Wolf was a pioneer in opening the eyes of the Con-

gress and the country to the espionage that China's been engaged in for so many years. He was the first one out of the gate to talk about this. He opened my eyes to it. And the entire—I can guarantee the House of Representatives supports this good man and his work.

And I just want to be certain that you and everyone at NASA understands how deadly serious this problem is and how important it is, that it's not just Frank Wolf, it's the entire Congress, and this subcommittee is behind him. He speaks for all of us. And we're going to back him up 110 percent on making sure the Chinese do not penetrate our space program. There's theft. The Inspector General should know, and I hope he's listening, that we stand behind our chairman on this effort in making sure that there is aggressive investigation and prosecution of not only the Chinese agents that are involved, but anyone at NASA that has helped them penetrate and be able to steal this technology.

And please stop trying to find ways, please, not just you but the entire agency, stop trying to find ways around the language that's Federal law that Chairman Wolf put in. You can't just look—it doesn't just limit this to bilateral. I mean, you can't—it's not—I heard you say earlier that you felt like NASA's in full compliance with this law and that maybe multilateral agreements might be okay. That's not the way the law reads. You want to read the law in its entirety. And, clearly, the purpose of the law is to prevent the Chinese from getting access to our space program because it's run by the People's Liberation Army.

Mr. BOLDEN. Congressman, I understand that.

Mr. CULBERSON. I want to reiterate we're behind this good man 110 percent.

Mr. BOLDEN. I understand that fully. No one was as concerned as I was when we had the alleged breaches of security anywhere in NASA, and I intend to make sure that it doesn't happen. But I would be derelict in my duty if I did not give you my position. And that is that I think we can work with countries and keep them from stealing our technology or doing whatever it is. We work with the Russians today, we're not perfect, but we do a pretty good job of keeping them from getting——

Mr. CULBERSON. Yes, sir. But this is an absolute prohibition.

Mr. BOLDEN. Congressman, I said I agree 100 percent. And I think we are complying. And if we're not, then it is my intent to make sure that our staffs get together again, because you just said there is obviously something that I am not understanding correctly. I did not think the prohibition inhibited or prohibited participation in multilateral activities. For example, going to a forum where there are multiple countries present there. I know I cannot enter into any agreement with the Chinese.

Mr. CULBERSON. Or hire contractors that employ Chinese and bring them in and put them over an F–20——

Mr. BOLDEN. Mr. Congressman, we are not doing that. If we find that we are doing that, then that is why the investigation is underway right now.

Mr. CULBERSON. Okay. Well, Chairman Wolf speaks for all of us on this.

Mr. BOLDEN. I understand that. Yes, sir.

Mr. WOLF. Okay. Okay. Thank you very much for your testimony.

Mr. BOLDEN. Thank you, sir. Thank you, Mr. Chairman.

Mr. WOLF. The hearing is adjourned.

Mr. BOLDEN. Yes, sir. Thank you very much.

QUESTIONS FOR THE RECORD—MR. WOLF

IMPROVING SECURITY ENFORCEMENT

Question. Within NASA's existing security regime, there are multiple offices with overlapping or similar jurisdictional responsibilities when it comes to protection of sensitive technologies and information. At the centers, there are center security officers, export control officers, counterintelligence liaisons, OIG investigators, IT security people and others. Are there clear and easily understood jurisdictional lines between all of these offices? If not, does the confusion increase the risk that concerns will end up unaddressed?

Answer. In addition to the Office of the Inspector General (OIG), whose statutory mission to assess all Agency operations, there are three additional offices with responsibilities for protecting sensitive information and technology within NASA. They are: (1) the Office of the Chief Information Officer (OCIO), with statutory responsibility for all unclassified information technology and unclassified information; (2) the Office of International and Interagency Relations (OIIR), with designated responsibility for Export Control; and, (3) the Office of Protective Services (OPS), responsible for all of NASA's physical, personnel and information security policies for classified systems and headquarters administration activities, protection program management and emergency management, intelligence reporting and analysis, special access programs, communications security (COMSEC), operation of all NASA's classified national security systems, and all counterintelligence and counterterrorism activities agency-wide.

There are clear, well-understood jurisdictional lines between the OIG and the OPS that are based upon a memorandum of understanding (MOU) between the two organizations as well as periodic meetings between the Inspector General and the Assistant Administrator for Protective Services. There also is a well-established understanding of respective responsibilities among the aforementioned offices as documented in NASA policy requirements and directives. There is a continuing close collaboration between the OCIO and the OPS focused on information security, which is based on their shared perception of the critical necessity to protect NASA's vital information and information technology systems. This has recently been demonstrated by the Chief Information Officer's decision to have OCIO cyber security personnel as well as a representative from the OIIR to participate in OPS security Functional Reviews of NASA Centers. Finally, there is a clear understanding of the jurisdictional boundaries between the OIIR and the OPS, and an initiative is currently underway to establish an MOU between the two organizations to further enhance collaboration in the area of Export Control. This is similar in principle to the MOU that currently exists between

the OIG and the OPS. All of these collaborative efforts are intended to minimize any lack of understanding between the organizations, or any risks that serious concerns could go unrecognized or unaddressed.

Question. What is the relationship between the security apparatus at Headquarters and at the centers? Would every significant allegation of a security violation to surface at a center be reported to Headquarters? Under what circumstances, if any, would Headquarters intervene in a center investigation?

Answer. The OPS provides executive leadership, policy, coordination, and oversight of all protective services-related activities throughout the Agency. The Assistant Administrator for Protective Services is the principal security, intelligence, counterintelligence and emergency management advisor to the NASA Administrator and the principal authority for the Center Directors in all matters relating to NASA security and related programs. With the exception of Center counterintelligence activities, Center Protective Services activities are under the control of the Center Director, not Headquarters OPS. However, concurrence from the Assistant Administrator for Protective Services is required when a Center Director appoints the senior Protective Services official at a NASA Center.

The OPS implements organizational standards and provides Agency advocacy to the Center Protective Services Offices to ensure NASA Protective Services programs are appropriately configured at each Center to properly and efficiently manage their day-to- day operations while allowing for transition to increased threat environments and emergency scenarios. This includes appropriate continuity of operations and contingency operations capabilities in support of the overall NASA mission, NASA Strategic Plan, and national-level security requirements.

To assist in consistency and Center conformity with applicable law regulations, national policy and NASA directives and procedures, the OPS conducts formal Center Functional Reviews to ensure the implementation, integration of, and compliance with the NASA Protective Services program requirements.

The AA for OPS has fostered a strong working relationship among the Center Protective Services Offices. At a minimum, the OPS conducts monthly teleconferences and, if funding permits, holds annual face-to-face operational meetings to discuss areas of current and future concerns, strategic planning efforts, and best practices. Additionally, each OPS functional lead remains in constant communication with their Center counterparts.

All adverse security-related events that may be of concern to NASA management are required by NASA regulation to be reported to the OPS. Such events include, but are not limited to: security violations, espionage, sabotage, natural disasters, serious accidents and injuries. All investigations that have

potentially serious implications are reported to the OPS in compliance with policy and procedure. The level of intervention by NASA Headquarters is dependent upon the circumstances of each case. In personnel security cases, because the OPS operates an Agency-wide Central Adjudication Facility to adjudicate all requests for access to Classified National Security Information (CNSI), all Center CNSI violation investigations are elevated to the OPS for review and appropriate action. All other investigations are conducted in concert with the OPS, the NASA OIG, the NASA Office of General Counsel, and local, state, and Federal law enforcement agencies in accordance with applicable memoranda of agreements (MOAs).

Question. Do all of your security-related offices have the resources needed to do their jobs appropriately?

Answer. NASA is enhancing its IT Security program with an additional $13M in funding in FY 2014, which will be used to improve monitoring and detection capabilities required to defend against current cyber attacks. We continue to assess constantly changing IT vulnerabilities and we will request additional funding as necessary to address and remediate IT Security issues.

FOREIGN NATIONALS AT NASA

Question. How many foreign nationals from designated countries currently have physical and/or remote access to NASA facilities and assets? Please provide this information by country and by center, and please include both foreign nationals and long- term permanent residents.

Answer. Material in response to this question was provided previously to the Subcommittee, and designated as Sensitive But Unclassified (SBU) information and not for public release.

Question. What steps does NASA take to minimize the number of foreign nationals from designated countries that are granted access to agency facilities and assets?

Answer. Foreign nationals who are approved for access to NASA's facilities are either restricted to publicly available information, or subject to Technology Transfer Control Plans (TTCPs), and sometimes to validated export licenses. Foreign persons from Designated Countries undergo additional tiers of review at NASA Headquarters by foreign policy experts; export control officials, and security professionals. This added review can serve to limit the number of persons from Designated Countries that may have access to NASA's facilities. Additionally, NASA's security and exchange visitor processes and guidelines specifically prohibit NASA's sponsorship of persons from Designated Countries

under NASA's unique J-1 visa authority. This also minimizes the number of such foreign persons in longer-term research programs that utilize that visa authority.

Question. What kind of background check do foreign nationals get before being approved for access to NASA facilities or assets? Does the background check differ in any way for foreign nationals from designated countries?

Answer. After a civil servant has confirmed that the foreign national user has a valid need to access NASA facilities or assets, the Center International Visit Coordinator (IVC) executes an investigation check. NASA uses a third party tool to execute a foreign national investigation called "Visual Compliance." Created by eCustoms, Visual

Compliance allows NASA to quickly complete a Restricted Party Screening against all relevant US Government lists including:

1. Specially Designated Nationals and Blocked Persons (SDN);
2. Department of Treasury Office of Foreign Assets Control (OFAC) Sanctions;
3. Department of Commerce Bureau of Industry and Security (BIS) Denied Persons List;
4. Department of Commerce BIS Entity List and Unverified List Department of State Arms Export Control Act Debarred Parties;
5. Department of State Designated Terrorist Organizations; and,
6. Department of State Nonproliferation Orders Screen against a comprehensive inventory of U.S. law enforcement, military, public service, banking, and international lists (including Japan Foreign End-Users of Concern, the United Nations and European Union lists of terrorist suspects, and Interpol.

If no findings are discovered, the Foreign National request is forwarded to the Center Export Control for review and documentation of the access limitations (provisos/conditions). Once Center Export Control has completed their activities, the Center IVC again reviews the request for any anomalies and, if approved, the request/identity is approved. The user or requestor can then request access to specific logical assets.

The request is sponsored for verification of need. If an application is marked as containing export control data, the Center export control reviews the request prior to the application approves access. The application approvers

review the export control provisos/conditions for the foreign national user before granting access.

For access requests for foreign nationals from Designated Countries, all of the above procedures apply plus, at the direction of the Assistant Administrator for Protective Services, beginning in 2012, the Center Counterintelligence Officers are notified of access requests for all foreign nationals from Designated Countries, including lawful permanent residents from those countries, and may make additional inquiries. Once the Center Export Control has completed their activities, the request is forwarded to the Agency Desk Officer assigned to that country and an associated mission for review. The Agency Desk Officer reviews the document, after which it is additionally reviewed by the Agency Export Control office. Finally, the Center IVC checks it again for any anomalies. If none are found, the request is approved.

Question. Background checks are no good unless they are sufficiently comprehensive to turn up any red flags resulting from an individual's behavior and activities both in the United States and in their home countries. How does the current NASA background check process accomplish this?

Answer. The background check capabilities/practices currently in use are the maximum that NASA has the authority to conduct and that are most likely to return meaningful information given the special challenges of investigating persons who are only in the United States for a limited time. Visual Compliance, the third party tool that

NASA uses for our foreign national investigations, allows rapid completion of a Restricted Party Screening against all relevant U.S. Government lists, including Specially Designated Nationals and Blocked Persons (SDN); Department of Treasury Office of Foreign Assets Control (OFAC) Sanctions; Department of Commerce Bureau of Industry and Security (BIS); Denied Persons List, Department of Commerce BIS Entity List; Unverified List Department of State Arms Export Control Act Debarred Parties; Department of State Designated Terrorist Organizations; Department of State Nonproliferation Orders Screen against a comprehensive inventory of U.S. law enforcement, military, public service, banking, international lists (including Japan Foreign End-Users of Concern; the United Nations and European Union lists of terrorist suspects; and Interpol. As warranted, NASA also conducts National Agency checks, with or without indices, and National Crime Information Center (NCIC) checks.

As with all security procedures, there is a level of risk acceptance and risk mitigation. NASA is committed to continually exploring options for reducing this risk and improving our approach to safeguarding all resources while at the same time balancing collaboration and the need for dissemination of knowledge

inherent in NASA's mission. NASA continually monitors and evaluates the status of all foreign nationals with access to our facilities through our defensive counterintelligence activities. The OPS Counterintelligence Division actively engages with NASA missions/projects as part of an education and awareness program and remains watchful for indicators that may be of concern.

Although foreign nationals are authorized access to common areas on Centers, there are layers of security (perimeter fences, CCTV –Closed Circuit Television [CCTC], electronic readers, etc.) in place that deter them from entering an area outside the scope of the TTCP. To ensure proper identification by security forces and during meetings, foreign national badges are distinguished by color so that they are easily distinguishable from other badges. Protective Services also conducts roving foot patrols of buildings and random vehicle inspections during both business and after-hours.

Within the last few weeks, the OPS initiated an effort to develop an integrated security strategy to address NASA mission requirements, mission support activities, facility requirements, and to improve our delivery of services, such as intelligence, counterintelligence and counterterrorism programs, security activities and security systems technical capabilities, to strengthen our efforts to protect NASA's people, property and information while facilitating accomplishment of NASA's programs, projects and operations. This effort is intended as a careful, deliberate, multi-year effort to maximize our return on investment in all of our security activities agency-wide.

While background checks alone will not always raise the proverbial "Red Flag," NASA is confident that integrating the multiple efforts discussed above reduces the risk to the Agency and maximizes the likelihood that potentially damaging acts will be deterred.

Question. When foreign nationals are approved to work at or visit NASA, specific limitations are sometimes placed on their access and behavior. What process is in place to proactively follow up and check on compliance with limitations contained in service and visit agreements?

Answer. NASA is committed to compliance with all U.S. export control laws and regulations including the Export Administration Regulations (EAR) and the International Traffic in Arms Regulations (ITAR). Foreign nationals who are approved for access to NASA's facilities are either restricted to publicly available information, or are subject to Technology Transfer Control Plans (TTCPs), and sometimes to validated export licenses. The TTCP's define both physical and logical access parameters for the foreign national.

Once on Center, a foreign national is authorized access to common areas. There are layers of security (perimeter fences, CCTC, electronic readers, etc...) in place that prevent a foreign national from entering an area outside

the scope of the TTCP. To ensure proper identification by security forces and during meetings, foreign national badges are distinguished by color so that that easily recognized as foreign nationals. Protective Services also conducts roving foot patrols of buildings and random vehicle inspections during both business and after-hours. While conducting these enforcement efforts, the officers are trained to verify compliance with badging and escorting procedures with the individual they encounter, and to document all violations.

OPS Counterintelligence is actively engaged with NASA programs and projects as part of an education and awareness program as well as looking for any indicators that may be of concern.

Question. In instances in which foreign national employees of a NASA contractor, grantee or other partner have been found to have committed security violations, does NASA hold that contractor, grantee or partner accountable in any way for the failure to appropriately screen or supervise their employees?

Answer. NASA is focused on preventing and prosecuting all security violations, regardless of who commits them; that is our duty and responsibility. NASA takes any allegation of a security violation very seriously, and follows long-established procedures to investigate these allegations quickly and thoroughly. These investigations are handled by our security and counterintelligence professionals in cooperation with the NASA Inspector General and other law enforcement officials, as appropriate. Generally speaking, if an instance occurs in which a foreign national is found to have committed a security violation, a Management Support Team is convened to investigate, discuss, mitigate, and address the violation. This generally includes the Office of Protective Services, the Office of General Counsel, the Contracting Officer or Contracting Officer Technical Representative, the sponsor, as well as any others required to participate under the specific circumstances of the violation. As a general statement, any deviation in the above set forth requirements/procedures may result in the revocation of IT access, unescorted access, or physical access to the Center, and/or disciplinary and/or legal action.

NASA would employ remedies under contracts and grants to hold contractors accountable for failure to appropriately screen or supervise employees. Such remedies may include replacement of the employee and/or supervisor, financial penalties, and negative past performance ratings.

In general, all violations have been minor in nature and corrective action has been taken by the sponsor and/or procurement officer. These types of violations involved a foreign national staying on Center after their designated work hours, or, in the case of foreign nationals requiring an escort, the violation involved a failure by the escort to remain with the foreign national until gate

exit. A Security Violation Incident Report is normally written to document the violation for future follow-up by NASA representatives. In most cases, the follow-up reveals assertions by the foreign national and the escort that they did not understand the requirements. Typically, both parties are reeducated and provided a copy of their responsibilities. The foreign national is also warned that future violations will result in a permanent denial of access.

There have been two notable cases involving foreign nationals:

- In July 2005, a KSC civil servant received a letter of reprimand for trying to circumvent foreign national vetting requirements.
- In August 2012, a GRC foreign national was identified by the Office of the Chief Information Officer to be accessing and viewing inappropriate (pornographic) material on a U.S. government system. This case resulted in the individual's physical access to the Center and IT access being permanently revoked.

Question. If a particular contractor, grantee or other partner demonstrated a pattern of failing to appropriately screen or supervise their foreign national employees, would that result in the contractor, grantee or partner losing their NASA support? Are you aware of any instances in which a contractor has experienced consequences as a result of lapses with their foreign national employees?

Answer. In the past seven years, there have not been any recorded instances where a contractor has experienced consequences as a result of lapses with their foreign national employees, nor have there been any known instances where a pattern of failing to appropriately screen or supervise their foreign national employees has occurred. If this were to occur, a team would convene to investigate, discuss, mitigate, and address accordingly. This generally includes the Office of Protective Services, the Office of General Counsel, the Contractor Officer or Contracting Officer Technical Representative, and the sponsor, as well as any others required to participate under the specific circumstances of the incident. Each case would be handled accordingly based on the facts associated with each reported incident.

In instances of demonstrated indifference to security requirements involving multiple violations associated with foreign national access, NASA would likely consider terminating the contract or grant. In addition, NASA would consider suspension or debarment of the contractor or grantee. While suspension and debarment are not considered punitive actions against the contractor or grantee, they are appropriate actions

in situations of repeated violations and demonstrated indifference because they protect the government from entering into agreements with such entities.

DISSEMINATION OF EXPORT CONTROLLED INFORMATION

Question. Is there sufficient awareness of export control responsibilities among your employees and other relevant individuals? If not, how can that awareness be increased?

Answer. NASA's Export Control Program was established nearly 20 years ago, and includes important education and training modules as critical elements of the program Requirements. Since the inception of the Export Control Program, continuous training has been provided across the Agency, including at all NASA Centers and JPL. Export Control awareness and compliance training is also available on-line at any time to every NASA employee and contractor. We continue to place a strong emphasis on Export Control awareness.

Question. If export controlled information is made publicly available, is the containment and removal of that information given first priority once it is discovered, even if doing so inconveniences or otherwise negatively affects other ongoing work?

Answer. Yes. Where there is a concern that information may have been inappropriately published without following proper NASA review and publication requirements, NASA acts promptly to restrict or eliminate access until it can be confirmed that appropriate reviews—including export control reviews—have been performed.

Question. When NASA discovers that export controlled information has been made available in violation of laws and regulations, you must make a voluntary disclosure to the State Department. How many such disclosures has NASA made over the past five years?

Answer. Since 2008, NASA has filed 11 voluntary disclosures with the Department of State. The overwhelming majority of NASA's voluntary disclosures concerned paperwork or shipment errors, none of which had any national security impact. In that same timeframe, we have only had one documented case that required disciplinary action against a NASA employee.

Question. Are you concerned that employees may be inclined to underreport potential violations because they don't want to make the agency or themselves look bad? How can you counteract any such hesitation to ensure that a full and accurate accounting of potential issues is reported?

Answer. No. NASA's Export Control Program requirements provide that "[a]ny NASA employee or NASA contractor concerned about questions of export compliance or impropriety in the area of export control should report those

concerns to the [appropriate Export Control official], in a timely manner" and that "[e]rrors in effecting exports or making transfers should not be concealed for any reason. It is better to uncover errors or mistakes, investigate, and understand the causes, and then make process changes to preclude future reoccurrence." Consistent with these principles, NASA has fostered a culture of compliance across the past two decades of its Export Control Program, and employees have a proven record of self-reporting errors, as demonstrated by the Agency's history of voluntary disclosures.

IT SECURITY

Question. NASA remains an extremely popular target for cyber attacks, some of which have been successful. How well do you think NASA protects its IT systems and networks from intrusions? Do you believe that you're doing better now than the last time you appeared before the subcommittee?

Answer. NASA faces dynamic and continuing challenges defending our information technology (IT) systems and networks from intrusion originating from individuals and organizations with malicious intent. NASA continues to improve its technical and procedural capabilities employed to: attain situational awareness of our information-security vulnerabilities and threats; and proactively defend the IT assets supporting our enterprise. Our collective actions, as well as information sharing with the Department of Homeland Security (DHS) and other Federal agencies involved in cyber security are contributing to an improved security posture.

NASA has made significant strides in the area of IT security and continues to add capabilities needed to improve the cybersecurity posture of our IT systems and networks. Since the action of one individual can cause unacceptable damage to the Agency and our partners, we are working with users of all systems within and connected to NASA to ensure proper compliance with the tools and procedures in place.

NASA employs the defense-in-depth strategy to protect our data and information systems. The employment of a defense-in-depth strategy provides NASA with a proven framework as we design, deploy and continuously assess our security posture based on best practices in the hardware, software and policy arena.

NASA is also making progress in updating our IT security frameworks, which enhances and automates monitoring and reporting activities across the enterprise. For example, the NASA Security Operations Center (SOC) is continually deploying sensors to attain enhanced visibility into NASA systems, enabling faster response times to discover, isolate and mitigate any negative or hostile incidents. The SOC was established in November 2008

to consolidate NASA's separate Center-based computer security incident detection and response programs into a single, Agency-wide computer security incident handling capability. In an August 2012 audit, NASA's Office of the Inspector General (OIG) found that the establishment of the SOC had improved NASA's security incident handling capability by providing continuous incident detection coverage for all NASA Centers. Additionally, the NASA SOC communication process, including weekly conference calls and security bulletins, is an effective method for sharing security- incident and threat information, NASA-wide. In fact, the OIG praised NASA for implementing an effective information system that enables Agency-wide management and reporting of IT security incidents.

A Trusted Internet Connections (TIC) 2.0 action plan has been developed and progress is on schedule. NASA plans to be above 95% by August 2014 (reaching yellow status). A Personal Identity Verification (PIV) pilot program, as well as an action plan has been developed to address identified PIV barriers. In addition, NASA is enhancing its IT Security program with an additional $13M in funding in FY 2014. Part of this funding will be used to deploy a single continuous monitoring program and to address additional portions of TIC implementation.

NASA has made improvements in securing its IT infrastructure, yet cybersecurity threats are ever evolving. NASA faces new challenges each day due to:

- The increasing number of employees who have the ability to conduct official business from alternate work locations;
- The increasing ability of employees to bring their own IT device (e.g. a personal cell phone) into the workplace when consistent with the Agency's security policies and procedures; and,
- The relative immaturity of IT security frameworks needed to support the mandate for executive agencies and departments to start using cloud computing for data and information services through the "Cloud First" policy.

In conclusion, NASA will continue to improve the security posture of our IT systems and network via focused, end-user awareness; integrated strategies to enhance protection; and the defense and security of our IT infrastructure.

Question. Last year at this time, NASA was just beginning an effort to encrypt all of its laptop computers. I understand that the encryption effort is complete but that some laptops were given waivers from the encryption

requirement. How many waivers were given, and what is the justification for allowing some laptops to remain unencrypted?

Answer. 90 percent (38,337 of 42,815) of NASA's laptops have been encrypted, and we are now working to install data at rest (DAR) full disk encryption on desktop computers that have sensitive information, such as sensitive-but-unclassified (SBU) information, personally identifiable information (PII) and information regulated by International Traffic in Arms Regulations (ITAR).

In some instances, DAR installation on select laptops/computer systems has not been possible for various reasons. In these cases, a waiver process enables NASA staff to perform their mission while addressing any potential risks from exemption. NASA's DAR waiver process details this residual risk and vets the risk decision process through appropriate NASA management channels. Only those requests that are absolutely necessary to support NASA's mission and business are approved. Waivers, delegated to cognizant officials, are available for a period of up to one year after which point they must be re-evaluated for relevancy and reapproved by management if still deemed necessary.

DAR waivers fall into six general categories:

1. *Mandatory Configuration Requirements That Preclude DAR Installation.*–This category may include on-orbit systems, lab systems that must remain identical to on-orbit systems, and flight support systems, as well as some continuity of operations and emergency operations systems. These systems cannot be readily replaced, but due to their age and configurations, cannot be made DAR-compliant.

2. *Scientific/Engineering Support.*—This category covers those instances in which the DAR encryption solution potentially impairs functionality of the data acquisition and analysis critical to scientific and engineering efforts.

3. *Special-purpose Devices Not Compatible With DAR Encryption.*—This category includes laptops that must use legacy software or interface with legacy hardware that is not compatible with current DAR solutions. This may include some facility-control systems such as fire alarms, lighting, trunk radios, or lab-equipment control systems.

4. *Alternate DAR Encryption Solutions are Implemented.*—This category includes laptops where the enterprise DAR solution cannot be installed. Instead, alternate DAR solutions that are compatible with the particular hardware or software have been implemented.

5. *Physical Protective Measures are Implemented to Prevent Theft.*—Laptops in this category have a business need for which DAR cannot be applied. However, they are physically tethered to desks, locked in racks, etc., to preclude theft or removal from NASA-controlled facilities.

6. *Short-term Waivers to Facilitate Program Closeout or Short-term Assignments.*—This category addresses situations in which contracts, programs, or projects are nearing end-of-life and the resource allocation needed to apply DAR would be cost-prohibitive; or users on short-term remote assignments or medical leave, to whose machines DAR will be applied when they return.

As of April 12, NASA management had approved 263 waivers covering a total of 4,478 machines, which represent a small percentage of our total laptop inventory. Each of these requests was submitted specifically to support a NASA business function or to prevent an unacceptable impact to NASA business inherent in the installation of DAR encryption. In addition, each waiver request detailed the compensatory measures implemented to mitigate the risk of exemption.

Question. What is the security status of your other mobile devices, such as tablets or smart phones?

Answer. NASA takes the security of all Agency information very seriously, and the proliferation of mobile technologies offers unique challenges to the traditional IT environment. Mobile devices provided by the Agency consolidated computer support contract are managed by a variety of tools including Blackberry Enterprise Server and Microsoft Enterprise ActiveSync technologies. In addition, Centers are assessing and piloting Mobile Device Management (MDM) solutions. The OCIO has convened a Mobile Device Management Integrated Project Team as well as a Bring Your Own Device (BYOD) Integrated Transition Team to leverage these efforts and ensure that these risks are considered and addressed at the Agency level, both from a policy and a technology standpoint.

Question. The NASA Inspector General believes that your security posture could be significantly improved by making changes in your IT security governance model. Specifically, he believes that the agency CIO needs greater authority over the activities of the centers. Why hasn't this change in governance been made? Why wouldn't we want to allow the CIO to dictate security policy and procedures to the centers?

Answer. The NASA governance structure currently provides that the Chief Information Officer (CIO) provides IT security policy and procedures to the

NASA Centers. In short, NASA IT security relies on centralized planning with decentralized execution. The NASA CIO is responsible for "...develop[ing] and maintain[ing] a NASA-wide information security program."[1] Accordingly, the NASA CIO "...[l]eads and implements NASA's IT Security program, ensuring appropriate confidentiality, integrity, and availability of all NASA's information assets throughout the system lifecycle."[2]

As part of the NASA-wide information security program, the Office of the Chief Information Officer (OCIO) has developed a number of IT security policies and procedures that apply directly to the NASA Centers. The NASA CIO has delegated the primary responsibility for the development and maintenance of the IT security policy and procedures to the Deputy CIO for IT Security at NASA Headquarters, while providing that the implementation of the aforementioned policies and procedures is the responsibility of the Center CIOs.[3]

To ensure that the IT security policies and procedures are implemented at the Centers, NASA has realigned the reporting structure so that the NASA CIO has direct authority and oversight over the Center CIOs. Specifically, the NASA CIO "[d]irects, manages, and provides policy guidance and oversight of the Agency's Center [CIO] activities, and operations, including in concurrence with Center Directors, the approval of the assignment, promotion, discipline, and relief of the principal CIO at each Center, and assesses their performance."[4]

Question. I am concerned that JPL's external status as a Federally Financed Research and Development Center means that its IT network and architecture are not controlled in the same manner as the rest of NASA's systems. Does JPL's status present an additional risk to IT security? If so, what leverage can NASA exert on JPL to bring its security standards and plans into better compliance with the rest of the agency?

Answer. Information security professionals across NASA and JPL face multiple IT risks and challenges defending their IT systems and networks. NASA performs due diligence to ensure that JPL and other vendors have undergone the proper accreditation of the systems used to store and process NASA information. In addition, NASA has added language to the JPL contract, which requires JPL to comply with our security guidelines.

Both NASA and JPL use the defense-in-depth framework to establish adaptable barriers across multiple layers of the IT assets and networks sup-

[1]NASA Procedural Requirement (NPR) 2810.1A §1.2.3.2.b
[2]NPD 1000.3D §4.8.2.1.l
[3]NPR 2800.1B §8.3.2 & 8.3.3
[4]NPD 1000.3D §4.8.2.1.c

porting our missions and programs. We work closely with JPL's CIO and Chief Information Security Officer (CISO) to identify and remediate security vulnerabilities. Moreover, both organizations collaborate to ensure intelligent application of techniques and technologies to improve the posture of our interconnected enterprise systems.

Question. The best IT systems in the world may not be able to stop security breaches based on simple human error, such as the leaving of an agency laptop in a parked car. What is NASA doing to reduce instances of IT breaches caused by human error?

Answer. IT security is a priority for the Agency and thus, we are extremely proactive in our approach to handling breaches caused by human error through awareness and education. NASA reaches out to every employee and guest with network accounts to notify them of best practices, both within the industry and within NASA. Employees are required to take mandatory training and are also afforded opportunities to engage in discussions with professionals during activities such as webinars, road shows, and IT security technical expos featuring guest speakers, and related activities. IT offices frequently provide desktop assistance to help users move sensitive information from mobile devices and onto more secure, less pilferable platforms. NASA employees will be held individually accountable for failing to adhere to our established procedures and policies.

While some human error may be inevitable, NASA has further protected data and the user community by implementing a mandatory DAR campaign, which ensures that every laptop is encrypted. As of May 10, DAR encryption has been installed on 100% of NASA laptops requiring DAR (i.e., not granted or requesting waivers via the enterprise waiver process). This campaign, as noted, is 100 percent complete. DAR ensures that if a laptop is stolen or lost, its data cannot be exploited or otherwise compromised.

As part of NASA's education and awareness campaign, NASA provides security- awareness tips, as well as articles in the NASA IT Security Awareness Newsletter and Web page. In addition, NASA provides monthly webinars, which it relates to various incidents and threats. NASA will continue to plan for a robust campaign on IT security, including partnering with other Federal agencies on such activities and programs.

USE OF SPACE ACT AGREEMENTS

Question. For non-reimbursable Space Act Agreements, NASA and a partner each pay for their own activities in support of a mutual goal. In theory, these agreements are supposed to ensure that the value of each side's contribution

represents an adequate quid pro quo for the other. What standards do you use to assess the adequacy of these exchanges? Are there any circumstances in which NASA would enter into an agreement knowing that the value of its contribution outweighs the value of its partner's contribution?

Answer. Under NASA Policy Directive 1050.1I, Authority to Enter into Space Act Agreements, the Signing Official is responsible for ensuring that the respective contributions from NASA and its partners are fair and reasonable under the circumstances. Therefore, before NASA may enter into a non-reimbursable Space Act Agreement, a cost estimate of the value of the NASA resources to be committed under the Agreement must be prepared and provided to the Signing Official. This ensures that the Signing Official has a basis for determining that the proposed contribution of the Partner is fair and reasonable compared to the NASA resources to be committed, NASA program risks, and corresponding benefits to NASA. This approach takes into account that the "value" of a particular partnership to NASA may not strictly correlate to the financial commitment of each party, but does ensure that the benefit to NASA under the agreement is commensurate with the NASA resources to be committed.

NASA does not currently have any exceptions to the policy stated above. It is the responsibility of the Signing Official, within his or her sound discretion, to ensure that the parties' contributions under a non-reimbursable agreement are fair and reasonable prior to executing the agreement on behalf of NASA.

Question. For reimbursable Space Act Agreements, NASA gets paid by a partner in exchange for assistance in support of the partner's goals. Do these agreements always provide full cost recovery for NASA? When would NASA deem it acceptable to recover less than its full costs?

Answer. Under NASA Procedural Requirement 9090.1A, Reimbursable Agreements, Centers are generally required to establish prices for work under reimbursable Space Act Agreements equal to the full cost of the work to be performed. Under the policy, NASA may agree to waive costs and adjust the price under the agreement to accept reimbursement for less than full cost, if the price after adjustment would be fair and reasonable, in light of NASA resources committed, NASA risks, and benefits to NASA. If the cost recovery for a reimbursable Space Act Agreement is anticipated to be less than the direct cost of doing the work, Centers are required to obtain approval from the Agency OCFO before proceeding with the agreement.

Waivers of costs under SAAs can only be considered where there is a clear and demonstrated NASA benefit. To the extent practicable, the benefit should be quantifiable so that its value can be reasonably estimated and compared with the unreimbursed cost.

As general guidance, consideration of whether to waive costs should be based on whether the NASA office absorbing the costs would be willing to pay for the benefits derived from the effort if the reimbursable agreement were not being entered into or if it would be willing to pay for the benefits separately assuming the full cost of the work for the customer were fully reimbursed. Acceptable bases for waiving costs are:

1. The benefits from conducting the work, i.e., work content or the results/deliverables of the work, are directly related to NASA's mission/program/projects, and there is a valid basis for charging an appropriate NASA mission/program/project as an alternative source of funding for some of the work.

2. The benefits derived from conducting the work, i.e., work content, or the results/deliverables of the work, are related to NASA's institutional programs, Center facilities supported by institutional resources, or other benefits that are general in nature and which are customarily supported by institutional funds that can include, but not be limited to, maintenance, improvement, or cost reduction of NASA capabilities or facilities.

In many cases, a waiver of costs should be considered to avoid an augmentation of NASA's appropriation when the reimbursable work will directly benefit a NASA program.

NASA will infrequently use "market-based" pricing in limited circumstances. A market- based price may yield more or less than full-cost recovery. Under NASA policy, market- based pricing resulting in less than full cost recovery may be used only when:

1. NASA real property or other assets or services are underutilized.

2. Full-cost pricing is not consistent with local market conditions, which can include a reasonable determination that pricing the property at full cost is unlikely to yield any customers.

3. The revenue derived would offset some or all of a budget requirement for the maintenance or disposition of the real property or asset, where some or all of those costs would be incurred by NASA even in the absence of the reimbursable agreement.

4. The price should still be at or above the marginal cost of providing the good or service.

Question. My understanding is that Space Act Agreements with foreign entities are reviewed by the State Department when those agreements are considered "significant" and are intended to be binding under international law. Does that mean that some foreign Space Act Agreements, such as those not deemed "significant," do not receive State Department review? Why is this?

Answer. NASA agreements with foreign entities under international law must be procedurally consistent with the Case-Zablocki Act, (1 U.S.C. §112(b)), and its implementing regulations, (22 C.F.R. §181). Before negotiating and executing an

agreement under international law, NASA submits the draft agreement to the State Department Bureau of Oceans and International Environmental and Scientific Affairs, which coordinates with the State Department's Office of the Legal Adviser to determine whether the "Circular 175 process," as described in 22 C.F.R. §181, is a required step prior to the negotiation of the agreement. If the C-175 process is required, the State Department and other agencies review the draft agreement and may provide comments. Such comments are typically incorporated before NASA is given authorization to negotiate and conclude the agreement. For NASA agreements with foreign entities concluded under U.S. Federal law, NASA advises State about such agreements when they are sensitive, e.g. for foreign policy reasons, and seeks the State Department's views.

Question. Does the State Department's review process serve a security function, in terms of screening potential agreements and partners for possible security risks? If so, how is that security function served when agreements do not undergo State Department review?

Answer. NASA cannot speak directly to the functions performed by Department of State's internal processes related to security as they pertain to the Circular 175 process, and we would respectfully refer the Subcommittee to the State Department.

Regarding security screening of Foreign Nationals for access to NASA, per Agency policy, all foreign nationals are subject to—and have passed—screenings under NASA's security protocols, including a series of database checks for each individual to identify persons who should be denied access. Access to NASA facilities and information technology assets is carefully scrutinized based on each individual's proposed need for access as well as a detailed security background review. The level of access also varies by individual.

Regarding NASA agreements with foreign entities, it is important to note that international partners are generally, although not exclusively, govern-

ment agencies, government-funded institutions, or universities. Proposals for international collaboration must be structured to protect against unwarranted technology transfer, and have clearly defined managerial interfaces to minimize complexity. NASA does not engage in joint development with its international partners (i.e., we do not "teach" partners to build space systems). Instead, NASA either restricts its collaboration to basic research, or, in cases involving the provision of components for each other's missions, NASA typically limits the exchange of information to that necessary to describe technical interfaces and ensure form, fit and function. To further limit the potential sharing of sensitive technologies with foreign governments, it is important to note that all NASA international agreements contain standard provisions on the exchange of technical goods and data, limiting such exchanges to those absolutely necessary to carry out the agreement, in compliance with U.S. export control laws and regulations.

COST CONTROL

Question. GAO recently found that the performance of NASA's major portfolio of projects (excluding James Webb) has improved in terms of cost and schedule growth since 2009. To what do you attribute this improvement, and do you believe it is sustainable?

Answer. NASA has taken steps to improve its acquisition management and continues to work to address systemic weaknesses. NASA has made some progress on the management and oversight of its major projects to improve overall acquisition outcomes, including the following:

- Revised acquisition and engineering policies to focus on enhancing formulation activities to provide better information for decision makers.
- Enhanced cost-estimating methodologies and ensuring that independent analyses are used to provide decision makers with objective representation of likely project cost and schedule results
- Institutionalized a management review process to improve management oversight of program and project cost, schedule, technical and cross-cutting component performance
- Continued focus to ensure training opportunities are appropriately targeted for program and project management learning and development activities
- Using a phased implementation approach to rolling out the EVM plan across In- house work in our programs and projects

- Enhanced focus on improving Program Planning and Control capability
- Implemented action plans to assess technical maturity throughout the project's life cycle with near-term and long-term deliverables
- Demonstrated some near-term success with projects such as JUNO, Grail, RBSP and LDCM all achieving launch under their development cost and schedule commitments.
- Since the rebaseline of JWST in 2011, the project has consistently remained within its new cost and schedule baseline. The project continues to make excellent progress meeting its annually established milestones and is actively working towards spacecraft critical design review (CDR) later this year. While challenges will remain through out the implementation phase, JWST has implemented several new mechanisms to improve communication between NASA and its contractors, at all levels of the project, in order to proactively respond to any issues as they may arise.

NASA recognizes that continued refinement, improvement, implementation and monitoring of sound acquisition practices, policies and processes is essential to reducing project cost and schedule growth on future missions. As highlighted in the GAO's draft report, NASA continues to implement several initiatives to mitigate acquisition management risks. We are extremely pleased to see progress toward improving cost and schedule performance, although we will look to see if this trend continues over the next several years before claiming success that our processes have reached the level of maturity and stability to endure the continuing challenges NASA faces in future years.

Question. Do you believe that large projects and small projects are held to the same standards with respect to cost and schedule performance?

Answer. All NASA projects are held to cost and schedule performance standards. Performance is reviewed monthly and also during life cycle milestone reviews. As part of the governance process, NASA categorizes projects by size, scope, and complexity. Depending on the project category, the reviews occur at the Agency level, Mission Directorate or Center level. Integral to the monthly review and life cycle review processes are mechanisms to assess technical and programmatic performance and take corrective actions when necessary.

Question. At NASA, project managers are rewarded for achieving the scientific and technical goals of their projects, but are they also rewarded for achieving

cost and schedule goals? How are they held accountable for their projects' success or failure at staying within budget and on schedule?

Answer. NASA has continued to focus on achieving cost and schedule goals in addition to technical performance as evidenced by recent policy and practice requiring rigorous programmatic assessment at key decision points, and monitoring performance against cost and schedule goals on a monthly basis. Project managers are held accountable through the monthly and life cycle review processes where cost and schedule success is recognized or failure to meet goals can warrant increased scrutiny.

JURISDICTION FOR WEATHER SATELLITES

Question. Last year, the Senate proposed moving all of the funding and responsibility for the procurement of civil weather satellites to NASA while leaving the operational mission and funding at NOAA. If the Senate proposal were enacted, you would have to transition and integrate an entire enterprise from NOAA. How difficult would this transition be, and would the complexity of the transition itself create programmatic problems for the satellites already deep into their development phase?

Answer. NASA and NOAA have been partners for more than 40 years in developing the Nation's polar and geosynchronous weather satellites. With the President's direction in 2010 to disband the National Polar-orbiting Operational Environmental Satellite System (NPOESS), NASA and NOAA returned to this successful partnership for JPSS. The NASA and NOAA teams have strengthened their working relationship over the last three years.

NASA has extensive experience and expertise in spacecraft and ground system development, operations, and procurement of complex satellite systems, including weather and Earth-observation satellites. The Agency has a demonstrated track record in spacecraft development and remains capable of developing weather satellites.

A transition of this complexity would require time and careful planning. No such transition is currently underway; instead, the FY 2014 Budget retains the current partnership arrangement, leveraging NASA expertise to support NOAA in the acquisition and development of weather satellite systems.

Question. If NASA had full procurement responsibility for the weather satellites, you would have to incorporate those missions into your existing project portfolio, which is already at the limits of what the budget will support. Is there a risk that the incorporation of the NOAA weather missions into the portfolio would force other projects out? What criteria would you use to make those trade-offs?

Answer. Under the current arrangement, NASA is the procurement authority, while NOAA provides programmatic direction and the funding on a reimbursable basis. As such, the President's FY 2014 budget request for the NASA Earth Science portfolio, which includes Flight, Research and Analysis, Applied Sciences and Technology programs, is completely independent of the weather satellite budget. NASA prioritizes its Earth Science portfolio to be responsive to the Decadal Survey, national needs and Administration priorities, while ensuring a balance among program elements.

While NASA has demonstrated success in cost-effectively managing a large Earth observing satellite program, incorporating the weather satellite program into NASA's existing portfolio and existing budget is not a feasible solution.

INFRASTRUCTURE

Question. NASA has struggled for decades with the challenge of rightsizing and modernizing its infrastructure, and every significant attempt to change the agency's footprint so far has largely failed. What is different about your latest efforts to rationalize NASA's infrastructure that will make this initiative more successful than previous attempts?

Answer. NASA continues to evaluate its infrastructure and capabilities to ensure that institutional resources align with mission and program requirements. Ongoing studies assessing NASA's technical capabilities will provide additional information to assist Agency leadership in making strategic decisions relating to the rightsizing and modernization of its infrastructure.

The Agency has identified assets that can be disposed or consolidated, and over the past three years has demolished 191 facilities and transferred 92 facilities to other agencies or private entities. This includes wind tunnels, large laboratory buildings, a nuclear reactor, test stands and several large Apollo and Shuttle processing facilities. In addition, we have disposed of or will dispose of major sites such as White Sands Space Harbor, GRC North Campus, Camp Parks, Crows Landing, Santa Susanna Field Laboratory, and other assets. This year, the Agency worked with GSA to successfully sell the buildings at the Glenn Research Center North Campus to private entities. The Agency is in the process of consolidating arc jet capabilities to one complex at the Ames Research Center. The Agency continues to dispose of excess buildings on NASA's Centers under our Disposal Program.

Ongoing fiscal considerations are challenging NASA to explore alternative mechanisms to make under-utilized assets available to commercial entities for use, thus reducing costs for maintaining these assets. As NASA continues to evaluate its infrastructure and capabilities against future mission requirements,

the Agency will continue to identify assets that are no longer required for mission purposes and will pursue their appropriate disposition in accordance with applicable authorities and regulations.

Question. Do you have a current, complete inventory of all unneeded and duplicative infrastructure across the agency? If so, do you have a plan for the disposition of each item on the list?

Answer. The Agency maintains a real property database that tracks all agency facilities and structures. The database is updated based on regular assessments that monitor the condition and utilization of individual assets. This system, together with an established process for Agency review, supports the identification of both underutilized facilities and those that are ultimately determined to be excess to NASA's mission requirements. NASA's roster of underutilized assets is continually evolving with changing mission requirements, condition assessments and other physical aspects that impact the use of facilities. From this roster, NASA manages an evolving set of those assets that are subject to determinations of excess and reporting to the General Services Administration (GSA) in accordance with Federal regulation, or demolition. NASA's management of its portfolio of excess assets is subject to the availability of fiscal resources; assets identified for demolition are prioritized in accordance with these constraints.

Question. By law, NASA must report as excess any property for which the agency has no current or future use. Based on various internal assessments, it seems like you have quite a number of properties that meet that standard. Have you reported, or are you in the process of reporting, all excess property to GSA as required by Federal real property laws?

Answer. Real property identified as excess to the Agency's mission requirements is reported to the GSA as excess. Because NASA's mission changes over time, some property that is under-utilized may remain on NASA's inventory for a period of time until a final decision is made that the property will not be required for future missions.

NASA has reported several properties to GSA as excess, including the Santa Susana Field Laboratory in California, Buildings 500 and 501 at the Glenn Research Center, and other assets at the White Sands Space Harbor and White Sands Missile Range in New Mexico, and at Langley Research Center.

BEYOND EARTH ORBIT EXPLORATION

Question. When you briefed the Committee on your fiscal year 2013 budget request last year, SLS was scheduled to reach project confirmation this spring and Orion this winter. A recent update from GAO, however, shows SLS' confirmation delayed to the fall and Orion's confirmation pushed into the middle of 2014. What happened over the course of the last year to cause these delays?

Answer. Regarding the Space Launch System (SLS) confirmation, NASA regrets that the schedule chart shown in the FY 2013 budget request briefing contained a typographical error. The SLS Key Decision Point-C (KDP-C) date shown in the chart was in fact start of the Key Decision Point process, not the conclusion. The KPD-C decision point should have been shown in fall of 2013 after the SLS Preliminary Design Review (PDR) milestone (i.e. in the NASA review process, PDR is an input to KDP-C, and thus precedes it). The current schedule for the SLS KDP-C remains in the fall of 2013. The Orion confirmation date moved as a result of cross-program integration activities. The integration of the Programs in the Exploration Systems Division required a re-phasing of activities both to ensure technical integration across the Programs as well as to fit concurrent developments within the budget profile for a first flight in 2017.

Question. Do the later project confirmation dates affect your ability to meet your various test flight goals over the next few years?

Answer. NASA does not anticipate that the flight dates for Exploration Flight Test-1 (EFT-1, 2014), Exploration Mission-1 (EM-1, 2017), and Exploration Mission-2 (EM-2, 2021) will be impacted. The Agency is rephasing a high-altitude abort test to better fit the overall development profile of its exploration systems, but that also will not impact the flight dates noted above.

Question. Because projects do not lock in a budget lifecycle cost estimate until confirmation, this delay means that your fiscal year 2014 budget request will not be based on firm, established estimates. In the absence of these estimates, what are you basing your fiscal year 2014 request on?

Answer. The FY 2014 budget request reflects NASA's estimates, which have been developed from the bottom up as the Agency and its contractors continue to make progress in developing the Orion Multi-Purpose Crew Vehicle (MPCV), Space Launch System (SLS), and Exploration Ground Systems.

Question. NASA still has not definitized and completed its contracts for SLS. This process will have an impact on project costs and could also have

ramifications for the schedule. The last I heard, NASA was planning to have all contracts completed by the end of this fiscal year. Are you still on track for that goal?

Answer. The SLS Booster contract was definitized on April 23, 2013. The other major SLS prime contracts (Engines and Stages) are on track to be definitized by the end of this fiscal year or soon thereafter. A letter contract for the Interim Cryogenic Propulsion Stage (ICPS) was awarded in September of 2012 and is scheduled to be definitized in early 2014. The definitization process will not impact project costs or have schedule ramifications because the undefinitized contract action has been accounted for in project budgets and all current SLS contract requirements, including schedule, are fully authorized.

Question. The Orion program is currently planning for a flight test in 2014. In order to meet that goal and stay within NASA's budget planning levels, however, the project has been required to start deferring some longer term work, such as the launch abort system, to later years. Isn't the deferral of work to stay within imposed budget constraints one of the major reasons that James Webb's budget got out of control? Are we repeating the same mistakes here?

Answer. The Orion MPCV Program has developed a flight test plan to support a first crewed flight on the EM-2 mission in 2021. This involves tests of the Launch Abort System jettison motors on the EFT-1 and EM-1 missions and the abort and attitude control motors on the 2018 Ascent Abort flight and the already flown Pad Abort Test in 2010. All necessary testing for the first crewed flight will be completed before EM-2 and not deferred.

The 2010 Independent Comprehensive Review Panel (ICRP) convened to assess the James Webb Space Telescope (JWST) program found that the project routinely needed to defer work to stay within its yearly funding cap. Two consequences of this deferral of work were the continual delay of the spacecraft element schedule relative to the rest of the observatory, and the routine rephasing of elements in the ground system (particularly at the Space Telescope Science Institute) to later dates. The project's practice of managing costs on a year-to-year basis led to deferred work and life-cycle cost increases. Lacking sufficient reserves needed to fund exigencies in the year they were encountered, the project simply continued to defer work into the future years where experience shows that the costs are potentially doubled or tripled. In the two years since JWST was rebaselined and provided with adequate funding and schedule reserve, the program has consistently performed within budget and on schedule.

COMMERCIAL CREW

Question. We have previously heard that NASA may choose to fund a few of the Commercial Crew Integrated Capability (CCiCap) optional milestones beyond the base period on an incremental basis. When will you make those decisions, and how will you ensure that the incremental funding of optional milestones does not end up undermining or unnecessarily delaying the awarding of certification contracts?

Answer. NASA is still evaluating whether to exercise optional milestones under CCiCap. As NASA's budget becomes more certain and as the companies mature their designs, NASA will determine whether exercising any optional milestones is in the best interest of the Government. The timing of the Phase 2 Certification procurement is independent of the optional milestones. NASA is expeditiously accomplishing the Phase 2 Certification contract procurement activities.

Question. NASA told us that the value of the CCiCap optional milestones is the insight they provide into the total estimated cost for each partner to reach a crewed demonstration flight. But the partners prepared those estimates using the assumption that all work would be done under a Space Act Agreement, which NASA now says is not going to be the case. So, are the lifecycle costs provided through the optional milestones still valid estimates of future funding needs?

Answer. NASA has developed Independent Government Estimates (IGEs) for each of the CCiCap companies' systems. These IGEs reflect NASA's current acquisition strategy of using SAAs for early design and development and using FAR-based contracts for certification. The life cycle cost estimates provided by the companies as part of CCiCap provide insight into each company's cost plans, but are not the definitive source for cost estimates. The estimates provided by the CCiCap companies were not used as a basis for NASA's IGEs, but rather as a reasonableness check on the estimate.

Booz Allen Hamilton concluded an Independent Cost Assessment (ICA) of NASA's IGEs. Results of the Independent Cost Assessment were briefed to Congress in conjunction with the release of the FY 2014 President's Budget Request. The Final Report from the Booz Allen Hamilton Independent Cost Assessment is posted on the NASA website.

JAMES WEBB SPACE TELESCOPE

Question. NASA has calculated a 66% joint confidence level for James Webb's baseline cost and schedule estimates. Those estimates, however, were produced before the final project schedule was finished and before major

Webb contracts had been definitized. Shouldn't the joint confidence level be recalculated to reflect the better information available after the completion of the schedule and the contracts?

Answer. NASA uses the joint confidence level (JCL) methodology to establish a program's baseline cost and schedule. Once those are established NASA employs industry standard metrics such as Earned Value Management (EVM), Estimate At Completion (EAC) and other schedule metrics to assess the progress of a project in adhering to the baseline established through the JCL. These metrics tell managers how closely the project is following the schedule and where cost and schedule deviations are occurring. Using that knowledge, managers can apply corrective measures or use unallocated future expense (UFE) funding to bring the project back to the JCL baseline. While the final project schedule and the Northrop Grumman Aerospace System (NGAS) contract were not definitized at the time the JCL was calculated, we are still tracking within the parameters for cost and schedule used for calculating the JCL

Question. NASA has said that once the joint confidence level process is used to establish a baseline, further assessments of the project's cost and schedule performance are done using different management tools. If the baseline is derived using one methodology, don't you need to continue using that same methodology to accurately track deviations from the baseline over time?

Answer. NASA does not use the JCL to track deviations from a baseline, nor was that the intent of the JCL. Rather a JCL is a probabilistic planning method of determining a program or project baseline at a specified confidence level. The analogy from science is that, once a computer model of some phenomenon is created, one uses measurements from nature or other computer models to test the original one. Using a Monte Carlo calculation to verify itself with the exact same methodology would not take advantage of the independent information collected via other assessment tools to track progress.

Question. GAO has indicated to the Committee that it is concerned about James Webb's ability to get through the integration and testing phase without incurring costly schedule delays. As you know, if such a delay occurs and the cost of the program increases, NASA must seek a reauthorization of the program from the Congress. What criteria would you use to decide whether to seek such a reauthorization in the event that it became necessary?

Answer. NASA will follow the mandated statutory reporting requirements for any cost increases and/or schedule delays, including specific cost increases and/or schedule delays that would require reauthorization of the program.

LAUNCH SERVICES

Question. NASA is facing a potential crisis in the small class launch vehicle market. As a result of this looming problem, NASA began a review of its options in the small class market with the goal of defining a concrete strategy for moving forward. What is the status of that effort?

Answer. NASA is in the process of evaluating industry responses to a "small-class" Draft Request for Launch Service Proposal (RLSP) that was released to the Agency's NASA Launch Services II (NLS II) commercial launch service providers on January 25, 2013. Responses were received on February 25, 2013. NASA expects to define its strategy for moving forward to coincide with the release of the final RLSP for the Agency's next small-class mission, known as Cyclone Global Navigation Satellite System (CYGNSS). NASA anticipates releasing the final RLSP in the summer 2013 timeframe.

Question. In the medium class market, NASA still has access to a limited quantity of Delta IIs, but no other medium class vehicles have been certified to fill the gap left in the market by the discontinuation of the Delta II line. Do you still feel confident that another vehicle will achieve certification before you run out of Delta IIs?

Answer. NASA is confident that one or more medium-class launch vehicles will achieve certification in the near future. For example, SpaceX is on a path to complete certification of their Falcon 9 version 1.0 launch vehicle in time to support the launch of Jason-3 in March of 2015. At this point, NASA has already completed the commercial launch service competitive procurements for all manifested NASA medium-class missions launching in FY 2014 through FY 2017. In the meantime, SpaceX and Orbital Sciences Corp. will be conducting flights to resupply the International Space Station. These flights will provide key experience and demonstrate the reliability of these companies' designs and processes. When a new medium-class mission is eventually added to the Launch Service manifest, there should be sufficient time for a new provider or a new launch vehicle (such as the SpaceX Falcon 9 version 1.1 and/or the Orbital Sciences Corp. Antares 120 and 130 launch vehicles) to complete certification for any launch of a high-value satellite subsequently awarded to them.

Question. What are your expectations for pricing trends in the launch vehicle market as a whole? Do you still expect prices to come down as the Air Force finalizes and implements its launch strategies?

Answer. The U.S. Air Force (USAF) launch strategy will primarily affect the "intermediate" commercial launch service market. NASA expects that the

USAF "block buy" strategy will provide stability for the industrial suppliers to the United Launch Alliance (ULA). This should help reduce cost uncertainty for NASA and all Evolved Expendable Launch Vehicle (EELV) users. Should reduced prices result from this "block buy" strategy, NASA expects to receive the reduced EELV pricing due to the terms and conditions it has on its NASA Launch Services II (NLS II) contract with ULA. NASA will see the results of this strategy as the Agency receives proposals in response to its NLS II solicitations for intermediate-class missions. NASA expects that the combination of the USAF "block buy" strategy and the evolving competitive situation within the intermediate-class will assist in reducing launch vehicle costs over time. NASA believes that the key to intermediate-class price reduction is competition within this class, as has recently been the case in the medium-class market.

PLANETARY SCIENCE

Question. NASA has said that it wants to integrate the Exploration and Space Technology programs into the new Mars 2020 mission, but it has never been fully explained how this will happen. What role will the Exploration and Space Technology programs play in the Mars 2020 project? Do you expect these programs to contribute funding to the project on top of funding providing through the Science Mission Directorate?

Answer. The specific payload and science instruments for the 2020 mission will be openly competed, following the Science Mission Directorate's established processes for

instrument selection. This process began in earnest with the establishment of a Science Definition Team (SDT) in February 2013. The SDT was chartered to outline the scientific objectives for a mission that "... will enable concrete progress toward sample return, thereby satisfying NRC Planetary Decadal Survey science recommendations, and will provide opportunities for accommodation of contributed Human Exploration and Operations Mission Directorate (HEOMD) payload element(s), technology infusion, and international participation." One of the four primary objectives of this group is to "provide an opportunity for contributed HEOMD or Space Technology Mission Directorate (STMD) participation, compatible with the science payload and within the mission's payload capacity."

The membership of the SDT was structured to support this goal, with experts in human exploration and space technology included among its members, and with subgroups established specifically to look at how HEOMD or STMD can participate. The work of the SDT is ongoing. A final narrative report is scheduled for delivery by July 2013. The SDT report will be

essential in formulating the NASA Headquarters-approved set of 2020 Mars rover mission science goals and measurement objectives suitable for open solicitation via a NASA SMD Payload Announcement of Opportunity (AO) that is to be released for open competition in Summer 2013. The final payload for this mission, and what will be the contributed HEOMD or STMD participation, will be determined during FY 2014.

Question. Lost in much of the debate about last year's proposals for the Planetary Science Division was the serious impact those proposals would have on NASA's small and medium planetary science projects, which offer high science return for a low investment and provide opportunities to train the next generation of researchers and project managers. How would you assess the health of the Discovery and New Frontiers programs?

Answer. NASA's Discovery and New Frontiers programs continue to manage a healthy portfolio of operating and development missions. The President's FY 2014 budget request provides additional funding for the Discovery program, which will allow NASA to continue its ambitious programs and to begin planning for a future Announcement of Opportunity for the next Discovery mission. All of NASA's current Discovery and New Frontiers programs are successfully exploring the solar system and setting the stage for future exploration.

The MESSENGER (MErcury Surface, Space ENvironment, GEochemistry, and Ranging) mission is a NASA-sponsored scientific investigation of the planet Mercury and the first space mission designed to orbit the planet closest to the Sun. The MESSENGER spacecraft launched in 2004 and entered orbit about Mercury in 2011 to begin a scheduled yearlong study. In 2012, MESSENGER completed its primary mission, embarked on an extended mission, saw its images and maps featured in the media, sponsored the release of a dedicated smartphone app, and celebrated the 8th anniversary of its launch, all the while continuing to produce new findings about the planet closest to the Sun. MESSENGER has now mapped 100 percent of Mercury's surface and provided the first global reconnaissance of the geochemistry, geophysics, geologic history, atmosphere, magnetosphere, and plasma environment of the solar system's innermost planet.

NASA's Dawn spacecraft spent a year orbiting and observing the large main-belt asteroid Vesta. Asteroids are scientifically important because they represent the bits and pieces left over from the solar system formation process. Dawn provided close-up views of Vesta and unprecedented detail about the giant asteroid. Dawn's observations confirmed that the asteroid had completely melted in the past, forming a layered body with an iron core. The spacecraft also revealed the collisions Vesta suffered in its southern

hemisphere. The asteroid survived two colossal impacts in the last 2 billion years. Without Dawn, scientists would not have known about the dramatic troughs sculpted around Vesta, which are ripples from the two south polar impacts. Dawn departed Vesta in August 2012, and is now on its way to its planned rendezvous in 2015 with Ceres, the only dwarf planet in the inner solar system and the largest asteroid, so large that it is estimated to contain a third of the mass of the entire main asteroid belt. Dawn will spend about a year exploring Ceres.

In August 2012, NASA announced the selection of a new mission, set to launch in 2016, that will take the first look into the deep interior of Mars to see why the Red Planet evolved so differently from Earth as one of our solar system's rocky planets. The new mission, named InSight, will place instruments on the Martian surface to investigate whether the core of Mars is solid or liquid like Earth's and why Mars' crust is not divided into tectonic plates that drift like Earth's. Detailed knowledge of the interior of Mars in comparison to Earth will help scientists understand better the processes that shaped the rocky planets of the inner solar system (including Earth) more than four billion years ago.

Last December, Ebb and Flow, the two spacecraft comprising NASA's Gravity Recovery and Interior Laboratory (GRAIL) mission, were commanded to descend into a lower orbit that resulted in them impacting a mountain near the Moon's north pole on December 17, 2012. The formation-flying duo hit the lunar surface as planned at a speed of 3,760 mph. The impact marked a successful end to the GRAIL mission, which has provided us with the most detailed gravity map of the Moon and helped engage thousands of students as NASA's first planetary mission to carry cameras fully dedicated to education and public outreach. GRAIL's MoonKam (Moon Knowledge Acquired by Middle School Students) Program led by Sally Ride Science, in San Diego, took more than 115,000 total images of the lunar surface; the GRAIL impact site was named in honor of Dr. Sally Ride, in recognition of her contribution to this mission.

NASA is also supporting missions of opportunity under the Discovery program, including the ASPERA-3 (Analyzer of Space Plasma and Energetic Atoms) instrument aboard the orbiting the European Space Agency (ESA) Mars Express spacecraft that is performing remote sensing measurements designed to answer questions about the Martian atmosphere, structure, and geology, and the Strofio mass spectrometer that is part of a suite of instruments that will fly on board ESA's BepiColombo/Mercury Planetary Orbiter (MPO), which is scheduled to launch in 2015.

In the New Frontiers program, all three missions continue to move forward successfully. New Horizons remains healthy and on course toward Pluto and the Kuiper Belt beyond. New Horizons, launched in January 2006, and set to

visit the Pluto system in July 2015, is currently more than half way between the orbits of Uranus and Neptune. The New Horizons spacecraft is the first to cross this distant region since NASA's Voyager probes in the late 1980s. New Horizons crossed the orbit of Uranus on March 18, 2011. It will pass the orbit of Neptune on Aug. 25, 2014—exactly 25 years after Voyager 2 made its historic exploration of that planet. The distance between the orbits of the two giant planets is about a billion miles. So far, New Horizons has traveled more than 2.3 billion miles since launch. It is closing in on Pluto, which is now approximately 711 million miles away from the spacecraft—nearly eight times the distance between Earth and the Sun.

Launched in August 2011, Juno will improve our understanding of the solar system's beginnings by revealing the origin and evolution of Jupiter. Underneath its dense cloud cover, Jupiter safeguards secrets of the fundamental processes and conditions that governed our solar system during its formation. As our primary example of a giant planet, Jupiter can also provide critical knowledge for understanding the planetary systems being discovered around other stars. After its arrival at Jupiter in July 2016, Juno will begin its roughly one-year mission to investigate the existence of a solid planetary core, map Jupiter's intense magnetic field, measure the amount of water and ammonia in the deep atmosphere, and observe the planet's auroras. Juno will let us take a giant step forward in our understanding of how giant planets form and the role these titans played in putting together the rest of the solar system. Juno is currently in the inner solar system, preparing for a gravity assist flyby of the Earth on October 9, 2013.

NASA is moving toward confirmation in May 2013 of the Agency's planned asteroid rendezvous and sample return mission, dubbed OSIRIS-REx (for Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer) that is planned to launch in 2016. After launch and traveling three years, the OSIRIS-REx mission will thoroughly characterize a near-Earth asteroid, currently named (101955) 1999 RQ36. 1999 RQ36 is believed to be the most exciting, accessible, volatile and organic-rich remnant currently known from the early Solar System; it also is thought to have abundant regolith (a blanket of loose materials covering rock) comprised of fine gravel that is ideal for collecting a sizable sample. With this sample, scientists will be able to analyze the asteroid's composition, mineralogy and geology to learn more about it and other organic- rich B-type asteroids; understanding more about near-Earth asteroids is particularly important in helping to protect the Earth from potential impacts. Once within three miles of the asteroid, the spacecraft will begin six months of comprehensive surface mapping. The science team then will pick a location from where the spacecraft's arm will take a sample of between 60 and 1000 grams (up to 2.2 pounds) for return to Earth in 2023. The careful study of 1999 RQ36 will permit scientists to

fully understand the context in which the sample was selected, which should greatly increase the scientific value of the sample. NASA recently sponsored a contest for students worldwide to re-name 1999 RQ36 and draw attention to the important issues surrounding NEOs. The contest deadline was December 2, 2012, and we anticipate announcing a winner in the coming months.

EDUCATION

Question. Some NASA education grantees have reported that their programs are being taxed by as much as 20% in order to free up funds for the implementation of elements of NASA's education proposals that have not yet been formally approved by the Congress. While I support some elements of those reforms (increased competition and accountability, for example), I cannot support their implementation without prior approval. Are these reports true?

Answer. No, NASA has not reduced any grantee's award in order to free up funds for the implementation of elements of NASA's education proposals that have not yet been formally approved by the Congress.

Question. I have also heard that NASA made some unexpected changes to the way in which Space Grant money is distributed and managed. Specifically, recipients say that NASA has reduced the size of a typical Space Grant award and used the savings to provide additional dollars to only a subset of Space Grant consortia. Did NASA make these changes, and, if so, why? Is this an indication of how NASA expects to administer Space Grant funds from now on?

Answer. NASA has not reduced the size of the Space Grant base awards. All consortia have received funds in alignment with their established multi-year grant awards. The period of performance for those awards is 2010–2014. In order to fully obligate all FY 2012 funds, the NASA Office of Education forward-funded a certain number of consortia for their Year Four Statement of Work. Those consortia did not receive additional funds; they simply received their established grant funds on an earlier schedule. In FY 2013, consistent with the Space Grant legislation, additional program funds (above fully funding the remainder of the base awards) are being competitively awarded. All consortia are eligible to compete for those funds.

EARTH SCIENCE

Question. During a discussion at the hearing about responsibility for NOAA's weather satellites, the Administrator testified that he would have concerns with any proposal to separate the management and funding of a program

from the agency driving that program's requirements. However, this is exactly what your budget proposes to do with USGS's Landsat program. Why should NASA continue to manage and fund Landsat projects that are driven by USGS requirements?

Answer. Unlike the situation with NOAA's weather satellites, NASA is responsible for the requirements, system architecture design, budget, and implementation of a sustained spaceborne land imaging system for the nation. The design of the system will be informed by USGS's in- depth knowledge of the broad base of users, and the user communities, for moderate-resolution multispectral land imagery. Indeed, the plan continues the effective historical approach whereby the USGS will process, archive and distribute the information products from the land imaging system.

In the case of the important operational meteorological satellite system, NOAA is responsible for setting and achieving the system's requirements and architecture; NASA's role has been, and continues to be, focused only on developing, launching and commissioning the satellite systems, which are funded through NOAA's budget.

Question. In addition to Landsat, the Earth Science budget also requires NASA to pay for NOAA climate sensors and DSCOVR earth observing instruments, neither of which has ever been identified as a NASA science priority. Why should NASA fund these tangential projects while some of your major established priorities (such as two of the four Tier 1 Earth Science decadal missions) go essentially unfunded?

Answer. NASA's research program is a key element in advancing Earth System science and developing applications that improve life for all citizens. Sustained measurements of solar irradiance, ozone profiles, and the Earth's radiation balance are important for NASA's—and the nation's—Earth science research, as identified in the National Research Council's *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond.* Given NASA's role as the nation's civil space agency, NASA has the expertise to design and implement these spaceborne global measurements for the nation.

With respect to DSCOVR, the mission is primarily focused on space weather and thus falls under NOAA's responsibility for short-term forecasting. However, DSCOVR efficiently utilizes a previously cancelled, NASA-developed spacecraft which included two Earth observing instruments. Integration and flight of the previously constructed Earth observing instruments is the most cost-effective and expeditious way to complete the DSCOVR satellite, so that it can begin its important space weather mission as soon as possible. Subsequent development of a basic ground processing capability in FY 2014

is a cost-effective way to redeem the nation's investment in these instruments, by allowing their measurements to be used to advance science.

PLANETARY SCIENCE

Question. Under this budget request and its associated runout, when do you anticipate making the next selections in the Discovery and New Frontiers programs, and how do these selection rates compare to the rates recommended in the planetary science decadal survey?

Answer. The next Announcement of Opportunity for the Discovery program is planned for release in FY 2014.

NASA expects to make the next New Frontiers mission selection in late FY 2016.

Question. The FY 2014 request for Future Mars missions, which includes the Mars 2020 rover, is only a small fraction of the amount projected for FY 2014 in the FY 2013 budget. Why is the budget so far below previous projections, and how will this slower growth rate over the next fiscal year affect your ability to retain critical skills in the Mars workforce and meet the 2020 rover's schedule?

Answer. The Mars Next Decade line in the FY 2013 request supported funding for all future Mars missions, including NASA's contribution to the European ExoMars 2016 orbiter, with its Entry, Descent and Landing Demonstrator Module (EDM), and 2018 rover. The reduction in the Mars Future Missions line of the FY 2014 request, compared with the Mars Next Decade FY 2013 request, accommodates funding, now bookkept in separate budget accounts, for the Electra radios for the 2016 European orbiter (and engineering support for their EDM) and the MOMA instrument for the 2018 European rover. The reduction also accommodates provision of additional funds for Curiosity operations now carried in the MSL budget account.

Currently, a Science Definition Team is working to outline the science measurements required to meet the objectives for Mars 2020, and the project team is assessing the engineering requirements and defining the overall mission concept, including the use of residual flight hardware and expertise from the Mars Science Laboratory (MSL) mission. As the mission concept is further developed, we will proceed to a Mission Concept Review and an openly competed payload Announcement of Opportunity in late summer/early fall 2013.

Making steady progress towards the 2020 launch will be critical to retaining the core capabilities in MSL-based Sky-Crane entry, descent and landing and Curiosity-class rover engineering systems. At the time of the FY 2014 budget

formulation, NASA was in the early stages of defining the 2020 mission, and significant uncertainties remain as to the phasing of the mission's overall budget pending the results of the Science Definition Team and the upcoming Mission Concept Review this year. The FY 2015 budget formulation process will provide the opportunity to assess Mars 2020 budget and profile needs based on this better understanding of the mission development.

Question. What activities have been displaced from the planetary science technology program in order to accommodate the dramatic growth of Plutonium-238 funding within a decreasing program topline?

Answer. Currently, the elements of the planetary science technology program include the Advanced Multi-Mission Operations System (AMMOS), In-Space Propulsion, Planetary Science Technology Planning, Radioisotope Power Systems, and Plutonium-238 production. The growth of the Plutonium-238 production activity in FY 2013 and FY 2014 was planned for in NASA's budget planning last year, and did not displace other activities.

Starting in FY 2014, the planetary science technology program portfolio will include the new responsibility to fund Department of Energy (DOE) Radioisotope Power Systems (RPS) Infrastructure. This funding was not taken from other activities. The budget planning exercises for this year are in progress and NASA is working to accommodate the funding for DOE RPS Infrastructure. In order to gain a better understanding of the scope and the funding required to maintain the necessary infrastructure to support NASA's RPS requirements, NASA will be performing a Zero-Base Review of the DOE RPS and Plutonium-238 infrastructure as requested by Office of Management and Budget (OMB).

AERONAUTICS

Question. How much money is in the budget request for hypersonic aeronautics research? *Answer.* There is $4.5M in the FY 2014 Aeronautics Research Mission Directorate (ARMD) budget for hypersonics research that is conducted under the High Speed Project in the Fundamental Aeronautics Program.

Within Space Technology, NASA includes $7.5M in the FY 2014 request to support research in aerothermodynamics and material thermal response relative to entry, decent and landing. This research was previously funded by the Aeronautics Research Mission Directorate, but is being transferred to Space Technology to facilitate collaboration and enable alignment with the Mission Directorate's entry, decent and landing technology development and demonstration efforts.

Question. What is the status of NASA's efforts to get the Department of Defense to assume responsibility for some of NASA's hypersonic research?

Answer. NASA continues to work closely with the Department of Defense to ensure that key hypersonics capabilities are available to support DOD needs. NASA and the DOD have worked together to assess hypersonics capabilities and a good working relationship exists between both organizations at multiple levels. At this point, we anticipate that key capabilities (e.g. The LaRC 8-ft High Temperature Tunnel) will be available in the near future if the need exists. NASA is in the process of establishing agreements on specific tasks where the DoD will reimburse NASA for certain hypersonic capabilities that are expected to start in FY 2014.

Question. The budget request says that NASA will assess options for the future of its rotary wing research over the course of FY 2014. What options will be considered? Will any of these options include a substantial reduction in rotary research during FY 2014?

Answer. The FY 2014 budget request includes $23.9M for rotorcraft research representing a $0.9M reduction from the FY 2013 budget request. Multiple options for rotary-wing research will be considered to assess options for future NASA-funded rotary-wing research. Options will include phasing out of the research, and considering how the portfolio can be modified to develop new innovative rotary-wing capabilities. Work in this field is being conducted by various other agencies and NASA will coordinate with our partners in the DOD and industry to make these assessments.

Question. Is the idea that NASA might reduce its involvement in rotary wing research driven by anything other than budget constraints?

Answer. NASA will explore options for the future of NASA-funded rotary wing research as part of our continuing efforts and obligation to ensure Agency investments address the most compelling national needs within the present constrained budget environment. These options will be based, in part, on an assessment of the roles and responsibilities among the key players in the rotorcraft community, especially other government departments and agencies that are actively involved in rotorcraft research. While a clear and unique NASA role might include R&D into innovative, futuristic new rotary wing systems, this must be prioritized within a balanced aeronautics/aviation R&D portfolio.

ASTEROID MISSION

Question. How does the search for an asteroid small enough and with the appropriate characteristics for NASA's potential asteroid capture mission contribute to the goals of the Science Mission Directorate?

Answer. NASA's goals include expanding the scientific understanding of the Earth and the universe in which we live. The Planetary Science Division (PSD) within NASA's Science Mission Directorate (SMD) helps NASA to pursue this goal in a number of ways—one of which is to seek to understand the characteristics of small bodies and planetary environments that pose hazards and/or provide resources.

SMD established the Near-Earth Object Observation (NEO) Program in 1998 for the purpose of coordinating NASA-sponsored efforts to detect, track and characterize potentially hazardous asteroids and comets that could approach Earth. With over 90 percent of the near-Earth objects larger than one kilometer already discovered, the NEO Program is now focusing on finding 90 percent of the NEO population larger than 140 meters. The proposed asteroid capture mission initiative will help accelerate enhanced capabilities in the search for all sizes of NEOs. It will use current and emerging capabilities to help detect both medium to large asteroids that may pose a hazard to Earth as well as small asteroids that could be targets for the proposed asteroid capture mission.

Question. In outlining the "flexible path" approach to beyond Earth orbit exploration, NASA highlighted a trip to an asteroid as a stepping-stone to Mars that would provide necessary expertise in radiation protection, long duration habitation and advanced life support. Would the asteroid capture mission be able to provide any of this expertise? If not, how will you achieve this expertise and how does the asteroid capture mission advance NASA toward the ultimate goal of a crewed mission to Mars?

Answer. Yes. NASA's strategy is to capture a near Earth asteroid and redirect it to a stable orbit in the Earth-moon system, followed by exploration and sampling of the asteroid by astronauts using the Orion Multi-Purpose Crew Vehicle and Space Launch System (SLS) assets. The mission comprises three separate and independently compelling elements: the detection and characterization of candidate near-Earth asteroids; the robotic rendezvous, capture, and redirection of a target asteroid to a stable orbit in the Earth-Moon system; and the crewed mission to explore and sample the captured asteroid using the SLS and the Orion. The radiation environment in this region of space outside the Earth's Van Allen radiation belts, is quite different than that encountered by astronauts on the International Space Station (ISS). The radiation environment is more akin to that expected for astronauts and spacecraft

in deep space journeys such as one to Mars. Thus, we will gain invaluable experience with radiation dosages as well as the character/composition of the radiation experienced inside the Orion vehicle, but without the dangerous levels of exposure projected for long duration (¿ 6 months) trips. Furthermore, the crew exploration mission of the captured asteroid will gain tremendous experience in mission operation capabilities beyond low Earth orbit. Unlike operating on ISS, the greater than 20-day round trip mission to the asteroid will have highly limited resources and no ability to quickly return/abort to Earth. As with an eventual trip to Mars, system reliability of life support, power, communications, control, and propulsion will be essential. But at least as important is the experience and knowledge gained in how to operate complex human space missions at remote locations. What we learn as we operate the Orion crew vehicle during missions to encounter and sample the asteroid will help us design the additional habitat and related systems needed for future deep space missions.

The mission integrates a variety of other technologies and capabilities important to future crewed missions to Mars and other deep space destinations. These include the acceleration of high power solar electric propulsion development (considered essential for future human exploration to Mars) and rendezvous with and maneuver of a non-cooperative target beyond Earth's gravity well. The crewed mission to the asteroid would enhance current test objectives for early flights of SLS and Orion to provide important additional experience in human space flight beyond Earth orbit toward the ultimate goal of a crewed mission to Mars. The mission will also identify challenges associated with operations beyond Earth orbit that require significant risk identification and mitigation in preparation for future Mars missions. These include the complex trajectories during the trip to and from the asteroid in a distant retrograde orbit around the Moon; rendezvous and proximity operations using the Orion spacecraft outside of the Earth's gravity well; deep-space operations such as guidance, navigation, and control nine days away from Earth; EVAs to explore the asteroid; and extraction, management, and return of samples in the Orion.

Question. What is the anticipated schedule for the completion of a mission concept review and the production of an initial mission cost estimate? Will the results of the concept review and the cost estimate be shared with the Congress prior to the submission of the FY 2015 budget?

Answer. NASA anticipates completing this summer a review of technical and programmatic feasibility for the asteroid redirect mission. This review will include a preliminary and independent cost estimate for the proposed mission. NASA will be happy to brief the Committee on status prior to the

submission of the FY 2015 President's Budget Request.

Question. In its report last year on NASA's strategic direction, the National Research Council "did not detect broad support for an asteroid mission inside NASA, in the nation as a whole or in the international community." Initial public statements from some international partners, such as the Germans and Japanese, seem to confirm their hesitancy to embrace this mission. How will you enlist the support and cooperation of international partners if their enthusiasm for this mission is limited?

Answer. On April 10—the day NASA's budget request was released—NASA Administrator Bolden made a series of calls to several of NASA's international space agency partners, thanking them for their current support of our space partnerships, and encouraging them to think about ways their future plans and interests may align with NASA's revised asteroid strategy. Feedback from those calls was immensely positive, proving that there is definite interest in international engagement with our asteroid strategy. Also on April 10, the NASA Associate Administrator for Human Exploration and Operations, William Gerstenmaier, provided the International Space Exploration Coordination Group (ISECG) Senior Agency Managers an overview of the asteroid strategy, to which the ISECG participants reacted positively.

Moving forward, NASA will continue to engage our international partners to provide further definition of our asteroid mission and exploration strategy, and to identify potential cooperation, both bilaterally and multilaterally. A workshop is in planning for this summer to broadly solicit ideas from the international, commercial, and scientific communities in areas of emphasis, including ideas on partnerships and leveraging of the asteroid redirect mission. Additionally, a NASA Mission Formulation Review that will be conducted this summer with a focus on the technical and programmatic feasibility of the mission should help inform more concrete discussions on areas of potential international cooperation.

Question. NASA's budget presentations claim that SLS is "fully funded", which the CFO told us is meant in relation to the numbers contained in the Independent Cost Assessment (ICA). While the request and the ICA are in the same ballpark, the cost estimates in the ICA represent procurement amounts only and do not account for civil service labor and other expenses. Does this mean the request is actually short of "fully funded" by several hundred million dollars?

Answer. No. The CFO's statement was that SLS has been fully funded through the formulation period, in relationship to the ICA (see table, below). As shown, the FY 2012 and FY 2013 requests are not "several hundred million

dollars" short of the ICA levels for SLS. The formulation period is scheduled to end in early FY 2014 with the Key Decision Point C milestone. At that time, NASA will make a cost and schedule commitment for development of the vehicle.

Table 1: Space Launch System (w/o Ground Systems) Formulation Years (Figures in all rows include the budget for SLS-required construction of facilities.)

	FY 2012	FY 2013
ICA as published	$1,157M	$1,212M
NASA calculation of ICA in full cost	$1,483M	$1,495M
Presidents Budget Request	$1,477M	$1,429M
Delta between PBR and ICA	-$6M	-$66M
Appropriated funds[5]	$1,555.5M	$1,548.4M
Delta between Appropriated and ICA	+$72.5M	+$53.4M

As that commitment is yet to be made, the FY 2014 President's Budget request, balancing the nation's goals for space exploration with the current fiscal climate, provides the necessary funding profile required to keep SLS, Orion, and EGS moving forward to achieve EFT-1 in 2014, EM-1 in 2017, and EM-2 in 2021. This includes procurement, labor, and other costs.

Question. NASA maintains that its request is sufficient to meet the 2014 and 2017 flight test goals for Orion and SLS. How will the request affect NASA's ability to work on long-lead items (like the advanced booster competition, or the J2-X engine) for which progress is needed now in order to meet flight goals beyond 2017?

Answer. The President's FY 2014 Budget Request supports not only the 2014 Exploration Flight Test-1 (EFT-1) and the 2017 uncrewed EM-1, but also the 2021 flight date for EM-2, the first crewed flight of Orion and SLS. The Agency is rephasing some work (e.g., the altitude abort test, now slated for 2018) to better fit the overall development profile of its exploration systems, but that will not impact the established flight dates for exploration missions. In order to evolve SLS to achieve the 105 metric ton (mT) capability in the 2023 timeframe, NASA will need to proceed with either the new upper stage or the advanced booster (the final 130mT capability will require both). NASA believes the outyear resources envisioned in the FY 2014 Budget Request will be sufficient to meet that goal in the 2023 timeframe.

[5]FY 2012 is the latest approved Operating Plan, anf FY 2013 is the Enacted less Rescission/Sequestration

COMMERCIAL CREW

Question. Will the findings of the commercial crew ICA affect your anticipated funding needs for fiscal year 2014 or future years?

Answer. While the FY 2014 Budget Request was formulated before the Independent Cost Assessment (ICA) was delivered, examination of the ICA findings shows that NASA's costs estimates used to develop the FY 2014 Budget Request are of high quality. The ICA identified three areas for potential cost growth (mass growth, systems integration, and provider profit). NASA agreed that additional cost risk exists in these three areas, though not to the same extent as envisioned by the ICA. The ICA findings do not affect the FY 2014 budget request of $821M. However, based on the ICA findings and work to be performed over the coming year, NASA will refine its budget accordingly in the next budget cycle. Appropriation at the level of the President's FY 2014 Budget Request is critical to maintaining the schedule and strategy for this essential program to once again launch U.S. astronauts to low Earth orbit from U.S. soil.

Question. Please break down the $821 million request between funds expected to be used for: Commercial Crew Integrated Capability milestones (including optional milestones), activities under the existing Certification Products Contracts, activities under the anticipated phase 2 certification contracts, and program management.

Answer. Of the $821M FY 2014 President's Budget Request for the Commercial Crew Program, approximately: $65M is allocated to Program Support (civil servant labor, travel, and other program support expenditures); $330M is allocated to base period CCiCAP milestones; and $15M is allocated to Certification Products Contracts. The remaining $410M is allocated to Phase 2 Certification activities. If determined to be in the best interests of the Government, NASA may use some of this amount to fund additional CCiCAP optional milestones.

Question. What is the expected schedule for the release of a Request for Proposals for the phase 2 certification contracts?

Answer. NASA expects to release the Request For Proposals (RFP) for the Certification Products Contracts (CPC) in the fall of 2013, with award(s) anticipated in the summer of 2014. To prepare for the final RFP, NASA expects to release a draft RFP for comment this summer.

EDUCATION

Question. Please provide a listing of the names and estimated FY 2013 dollar amounts associated with each education program that is being moved under the control of the Office of Education from somewhere else in the agency.

Answer. Two projects are being consolidated within the Office of Education from other parts of the Agency in FY 2014.

The Global Learning and Observation to Benefit the Environment (GLOBE) activity was funded by the NASA Science Mission Directorate in FY 2013 at approximately $4.5M. In FY 2014, the program will become an activity within the Office of Education with a proposed budget of $4.5M.

The Aeronautics Scholarship was funded by the NASA Aeronautics Research Mission Directorate in FY 2013 at approximately $1.8M. In FY 2014, the program will become an activity within the Office of Education with a proposed budget of $1.8M.

Question. Please provide a listing of the names and estimated FY 2013 dollar amounts associated with each education program that is being consolidated with education programs at NSF, Department of Education or the Smithsonian.

Answer. In support of the Administration's FY 2014 STEM education plan, NASA will restructure fundamentally the Agency's education efforts into a consolidated education program funded through the Office of Education, which will also lead the Agency's coordination with other Federal agencies in pursuit of the Administration's STEM education goals.

NASA's budget request includes $19.9M for funding through an internal competitive process the best application of NASA education assets to meet the goals of the Nation's STEM Education efforts, including engagement. It is not possible at this time to provide the list requested, since existing scholarship, fellowships and grants for graduate students and educators may compete for these NASA funds, or may be continued in coordination with other Federal agencies. Appendix Table A6 of the recently released CoSTEM Strategic Plan contains list of affected NASA programs and can be found at `http://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf`

Question. Did NASA have any discussions with NSF, Education or Smithsonian prior to the release of the President's Budget about how those agencies would administer the consolidated programs in order to ensure that NASA's specific needs will still be met? If yes, what was the outcome of those discussions?

Answer. NASA has a long history of collaborating with the three agencies, including joint exhibit development, coordination on evaluation strategies, and shared priorities for STEM education. Additionally NASA and NSF are the co-chairs developing the CoSTEM strategic plan. As part of NASA's STEM interagency coordination effort, NASA will ensure that the Agency's assets are put to use effectively in support of the STEM activities that will be directed by the National Science Foundation, the Smithsonian Institution, and the Department of Education.

Questions for the Record—Mr. Culberson

ARC JET FACILITIES

The following questions are in reference to the NASA Engineering and Safety Center Technical Assessment Report: Impact of NASA Arc Jet Complex Consolidation on the MPCV Program and TPS Margins (Nov. 29, 2012):

Question. What was the impetus in doing this assessment? Who specifically requested it?

Answer. The NASA Chief Engineer asked for the assessment. The assessment was targeted at understanding the historical differences in test results achieved at the ARC and JSC facilities with a focus on any additional testing needed to make the historical data sets as useful as possible.

Question. What was the purpose of completing this assessment if NASA had already decided to consolidate the Arc Jet complex?

Answer. The intent was to minimize the amount of repeat testing required for already tested materials by understanding any intrinsic or extrinsic differences in the prior testing.

Question. Is there anything in the findings that have caused NASA to reconsider the decision to close the arc jet at the Johnson Space Center?

Answer. There were no findings that called into question NASA's strategy of proceeding with a single arc jet testing facility.

Question. What is the ultimate impact to MPCV testing and certification as a result of the Arc Jet consolidation?

Answer. There will be no impact to Orion MPCV testing and certification when arc jet testing is consolidated at Ames Research Center. The Consolidation Project requirements were developed with agreement between JSC Engineering, the Arc Jet Consolidation project (sponsored by the Office of Strategic Infrastructure), and Orion MPCV, under the guidance of the Office

of the Chief Engineer. The arc jet consolidation requirements meet Orion MPCV testing and certification needs.

ADDITIONAL QUESTIONS

As recent as October 17, 2012, you (Administrator Bolden) are quoted as saying, "Mars is the goal."

Question. If that is indeed the goal, and many Administration's have believed it to be so, why would you close the only NASA test facility currently capable of being able to test for Martian atmospheric conditions for TPS development in lieu of trying to build one consolidated facility?

Answer. The Ames arc jet has been used to all qualify heat shields for Mars science probes, including most recently the Mars Science Laboratory. Neither facility can test large samples for Earth entry return from mars; very small samples can be tested at both.

NASA's decision to consolidate Agency arc jet capabilities at one location is based on recommendations of internal studies that considered the condition of the equipment and infrastructure that comprise and support the existing, aging facilities at Johnson Space Center (JSC) and the Ames Research Center (ARC). The Arc Jet Evaluation Working Group (AJEWG) concluded in 2010 that NASA's arc jet ground test capability is a critical and strategic requirement for NASA to achieve its mission. The AJEWG also concluded that the arc jet requirements can be consolidated into one location having multiple test capabilities.

As we have previously asserted, under current and anticipated future budget constraints, NASA simply cannot fiscally continue to operate and maintain two separate arc jet facilities, particularly given the significant need for strategic repair and infrastructure upgrades at both facilities. NASA made the decision in 2011, to consolidate the NASA arc jet capability at ARC.

Question. With the continued funding issues, if this capability is entirely lost for some reason, it will likely never be rebuilt. What is the back-up testing option for THIS capability (Mars) if the consolidated facility development is not successful?

Answer. As planned, the consolidated arc jet requirements establish the capabilities necessary to meet the agency's goals. In spite of fiscal constraints, NASA fully expects the consolidated facility efforts to be successful and does not foresee any reason for this capability to be entirely lost.

Question. What is the current status of the Arc Jet heaters at the Johnson Space Center?

Answer. The 10-megawatt rated JSC Arc Heater TP-1 has been relocated and installed at Ames and is in the process of activation and check-out. During this process, ARC continues to operate its high-powered arc heaters (up to 60 megawatt rating) for a variety of U.S. Government customers, including Orion MPCV and DoD. The JSC Arc

Heater TP-2 will be decommissioned by the end of FY 2013 after it completes its obligations. Afterwards, TP-2 and any other arc heater components will be disassembled and shipped to Ames for storage as critical spares.

Question. At the hearing, you noted a desire for flexibility within the Exploration account so that funds could be moved to SLS when needed. Would you also like the appropriations legislation to provide flexibility for moving funds from SLS?

Answer. The key point about funds flexibility within the Exploration account is to ensure that the Space Launch System (SLS), Orion Multi-Purpose Crew Vehicle (MPCV), and Exploration Ground Systems (EGS) work are all phased to support Exploration Mission-1 (EM-1) in 2017 and Exploration Mission-2 (EM-2) in 2021.

Question. I am told that maintaining a flat-line, constant funding profile for a rocket development program is the most expensive way to build a rocket, would you agree with this?

Answer. If funding is readily available, a flat-line funding profile for a system in development is not optimal from a program management perspective, but, per the response to the question above, NASA is working to ensure that spacecraft, launch vehicle, and ground infrastructure development are synchronized to support the mission launch dates for EM-1 and EM-2. The overall program and hardware selections were based on the anticipation of a nearly flat budget. The program formulation was chosen to minimize the effects of a flat-line budget.

Question. I remain concerned that OMB seems to impose a multi-year budget of 1.1 billion dollars per year for the rocket development portion of the SLS work, which seems to be an artificial limit to me. Will your FY 2014 budget request ensure that SLS receives the appropriate budget increases in FY 2014 and FY 2015 associated with a normal DDTE funding profile in order to keep the SLS program on schedule and to serve our country's space launch needs in a timely way?

Answer. There is no Administration budget cap on the rocket development portion of the SLS work. The FY 2014 President's Budget request, balancing the nation's goals for space exploration with the current fiscal climate, provides the necessary funding profile required to keep SLS, Orion, and EGS moving forward to achieve EFT-1 in 2014, EM-1 in 2017, and EM-2 in 2021.

QUESTIONS FOR THE RECORD—MR. ADERHOLT

Question. Has NASA considered having the SLS serve as the launch vehicle for the Europa outer-planets flagship mission? And if so, would the SLS offer any advantages over other existing launch vehicles in terms of a reduced travel time to the gas giant systems, an increased amount of scientific payload that could be delivered to the Jovian system, and a reduction in the complexity (and thus the risk) associated with the many folding structures that would need to be designed into the orbiter spacecraft if it were launched on a currently-existing launch vehicle? As a follow-up to your comments at the hearing, please comment on the value of finishing the J2-X as part of SLS-Europa mission, as compared to mothballing that engine.

Answer. NASA has conducted preliminary internal discussions concerning the potential use of SLS as a launch vehicle for a future mission to Europa, and these discussions are ongoing. These preliminary discussions need to continue as the design of the Europa mission and the SLS mature, but based on these initial discussions it does appear that the use of the SLS would substantially reduce travel times. However, the SLS will also likely cost more than any other rocket that might be considered for launching the mission. NASA intends to use part of the funding appropriated to Science by Congress for FY 2013 for pre-formulation of a potential Europa mission to study in more depth the potential use of SLS as the launch vehicle for a future Europa mission.

Question. The NASA Inspector General mentioned his plan to open an audit of the SLS program. What are your plans to allow confidential and anonymous input and feedback as necessary from current and former NASA staff, in order to ensure that this audit does not become merely a tool to artificially inflate the cost of SLS?

Answer. Audits of NASA carried out by the Office of the Inspector General are carried out independently of the Agency, and it is up to OIG to determine how best to collect information to enable them to conduct their audit.

Question. It is my understanding that the commercial cargo and crew programs are different from prior NASA programs, such as Apollo, in that the

taxpayer does NOT own the intellectual property from these, even though the taxpayer has funded 80 to 90 percent of the work. I have also been told that the commercial companies involved in the cargo and crew programs could sell their technology to other companies and other countries, as long as ITAR provisions were not violated. Is that correct?

Answer. It is important to note that the laws addressing government-funded intellectual property have changed significantly since the Apollo era. Contractors now retain ownership rights in intellectual property (including the right to sell the technologies to others) even under FAR contracts and the Federal government receives a license to support future government use.

The Commercial Crew Program supports the goal to "seek and encourage the fullest commercial use of space," a stated purpose of NASA under the National Aeronautics and Space Act of 1958 (the "Space Act"), as amended. In order to foster such commercial use, participants in the commercial cargo and crew Space Act agreements (COTS, CCDev, and CCiCap) retain maximum Intellectual Property (IP) rights permitted by law.

NASA does receive data generated by our partners under these agreements, for NASA's use in evaluating the partner's performance of the agreement milestones. Under CCiCap, NASA does not obtain rights to use our partner's data for other purposes unless special circumstances arise, such as termination of the Space Act Agreement (SAA) for the partner's default or our partner's failure to make commercial use of the technology developed under the SAA. NASA retains "government purpose" rights in reported inventions owned by the partner as required under the Space Act. NASA has agreed not to exercise its "government purpose" rights for specified time periods after the end of the SAA. NASA's ability to exercise its government purpose rights in inventions is accelerated in the event of the partner's default. This means that, in the event of default, the data and inventions can be used by or on behalf of NASA in future development efforts.

NASA has determined that title to all tangible property acquired by the participant under the COTS, CCDev, and CCiCap agreements will remain with the partners. Unlike a procurement contract, the purpose of a funded Space Act Agreement is not to obtain property for NASA. Instead, it is to stimulate the partner's own commercial efforts. However, NASA reserves the right to acquire any tangible personal property acquired or developed under the SAA from the SAA partner, taking into account the amount NASA has already contributed under the agreement.

NASA has not made a final determination regarding IP for the upcoming Phase 2 Certification procurement/contracts.

Question. It is my understanding that the original cost of the commercial

space program, for transporting cargo to the International Space Station (ISS), known by the acronym COTS, was $500 million dollars; and that the program was behind schedule, and Congress provided another $300 million dollars. Further, it is my understanding, in part from a NASA press release of 2008, that NASA signed contracts with two companies; one contract for 12 flights, and one for 8 flights. Each contract is to take 20 metric tons to the ISS, under a program known as the Commercial Resupply Service, or CRS. As of the end of February, the disbursements to the two companies, added together, is 1.243 billion dollars of CRS funds, according to information received from NASA by my staff. COTS and CRS funds together represent $2 billion, 6.7 million dollars. Space X is the first to achieve flight to the station, and 12 flights would average roughly 3,675 pounds to the ISS in order to equal 20 metric tons. The 1.6 billion dollar contract figure, divided by 12 flights yields an average flight cost of 133 million dollars per flight. These

first two flights by Space X have taken 2,150 pounds, total, to the ISS. A chart from NASA shows that 553.9 million dollars of CRS funds had been provided to Space X by Feb. 28 of this year. Even if some of those funds are payment for various tasks included in the next two to three flights, the taxpayer has essentially paid an amount that exceeds the cost of 4 flights. Regarding the pounds taken to orbit, if you divide 2150 pounds into the 553.9 million dollars, plus the 400 million dollars Space X received from the COTS program, taxpayers have paid $954 million dollars thus far for these two flights. That equals $443,720 per pound for cargo to the ISS. If you count only the 554 million dollars of CRS funding, the cost is $257,209 per pound. In a 2011 hearing, the House Committee on Science reported a cost of about $18,000 per pound by the Russian vehicle "Progress," and estimated the cost of Shuttle-launched cargo at about $26,000 per pound. As you know, even though Space X is the first of the two companies to reach the station, their launches were approximately 3.5 years later than the original milestones. In light of the delays in the program, and the costs, have you considered recompeting these contracts and suspending further CRS payments, especially in this time of budget cuts and sequestration? Also, please provide a clear and detailed explanation of why a supposedly innovative, supposedly competitive, approach to supplying cargo to the International Space Station is currently operating at a cost of ten times the cost per pound offered by the Shuttle Program.

Answer. The CRS providers are playing a key role in maintaining the International Space Station, and the progress to date meets our goals.

There is tremendous variability in the cost-per-pound value depending upon the assumptions used. NASA does not purchase cargo transportation on a dollar/pound basis, and therefore the cost/pound is a derived value

and subject to the assumptions used in the calculations. In addition, cargo mass capability is used by NASA and the contractor as a consistent overall measure of each vehicle's performance. NASA, based on how it packs the individual bags, flies additional internal or external powered payloads or particular groupings of cargo, may use each vehicle capacity differently. The cargo mass then used per mission will be dependent on each mission's unique configuration. In many cases, volume, and not mass, is the constraining factor. The first two SpaceX flights were needed most for cargo return capability. The ISS freezers were filling up and return of these important samples was critical. These flights were required to fly freezers and cold stowage for return. This resulted in the low mass fraction noted in the question.

The cost of transporting cargo to ISS varies by vehicle. Significant differences exist among the vehicles that have transported, or are slated to transport, cargo to ISS. It should also be noted that even within a specific vehicle type, the exact cost per pound will vary depending upon payload packing factors.

The FY 2011, cost for cargo transportation using Progress was $19.6 thousand per pound. The Progress vehicle can carry 3,080 pounds of pressurized/internal upmass per flight and dispose of an equal amount during reentry. The Progress is also capable of transporting an additional 2,640 pounds of fuel, water, and gases. The U.S. has purchased only a portion of this capability on multiple flights. In FY 2011, NASA purchased a total of 3,080 pounds of cargo delivery and 3,080 pounds of cargo disposal at a cost of $60.5M. Therefore, the associated cost per pound for both cargo delivery and disposal would be $19.6 thousand. NASA no longer purchases cargo delivery from the Russians. NASA's desire is to use U.S. cargo transportation services.

The average cost for contracted cargo transportation using the Commercial Resupply Services (CRS) vehicle mission costs and the contracted vehicle capabilities is $26.9 thousand per pound. NASA has ordered a total of 20 flights on the CRS contracts valued at $3.5B from FY 2011 - FY 2016. This provides for delivery of approximately 132,000 pounds of cargo, including 88,000 pounds of pressurized upmass and 44,000 pounds of unpressurized upmass, as well as cargo disposal and/or cargo return. Therefore, the average cost per pound for cargo transportation is $26.9 thousand. These costs include trash disposal and downmass. The actual cost per pound for each mission, based on the actual cargo flown, the density of the cargo, whether or not there is external cargo manifested, could raise that price to as much as $39.4 thousand per pound. Again, this is a derived value, as NASA's requirements are driven by mission need and not by cost per pound considerations.

NASA did not calculate the cost per pound to fly payload to the ISS on the Space Shuttle. Any derived cost-per-pound figure would have been the product of a number of assumptions about factors, which were extremely

variable. For example, the figure would be affected by the amount of payload flown and the operating tempo of the Space Shuttle Program. In addition, the cost-per-pound number would vary depending on whether the cost to transport astronauts to ISS and return them to Earth was included in the calculation. Finally, in the case of the Space Shuttle Program, NASA owned and maintained the associated facilities and infrastructure required to launch, operate, and land the vehicle (as well as refurbish it for further flights); this is not the case with other providers. If one assumed a flight rate of four missions per year, a payload upmass capacity of 35,264 pounds, and an annual program cost of $3.0 billion (which reflects the ramp-down of production towards the end of the Program), the cost per pound would be in the range of about $21.3 thousand/pound to $51.0 thousand/pound. These numbers are based on historical data for Shuttle and the support it provided to ISS. It does not take into account the fact that ISS logistics needs today are very different than when Shuttle was supporting ISS assembly complete and full outfitting. Further, the cargo flown on Shuttle, just as with the commercial cargo providers, was driven by mission need and not by maximizing a single parameter weight to orbit.

NASA plans to transport smaller amounts of cargo to and from ISS at least three times per year to meet NASA's research and other requirements. The smaller CRS vehicles are well suited for that mission. The Shuttle, which was optimal for assembly flights, had much more large-module carrying capacity than is needed for the post-assembly phase. To make the comparison more equitable for pre- and post-Shuttle logistics cost comparisons, NASA would need to match up the cost of the needed flight rate with the cost of flying only the required upmass. The cost per pound would increase as approximately only one Shuttle flight per year would be required. The basic Shuttle overhead of $2–3B per year would remain. The Shuttle flight cost would go to that value,

dramatically changing the Shuttle cost per pound, and research would be impacted. The more frequent cargo flights of the commercial providers enables more timely research equipment delivery. This is another reason why cost per pound is not an appropriate measure of the efficiency of the different modes of transportation.

Question. What is the total cost paid to Space X for the second CRS flight? NASA would not provide this answer to my staff, which makes it difficult for Congress to execute its oversight responsibilities on behalf of the U.S. taxpayers.

Answer. In December 2008, NASA awarded two contracts for commercial cargo resupply services to the ISS (one to Orbital Sciences Corporation and

one to Space Exploration Technologies); at the time of award, NASA ordered 12 flights valued at ~1.6B from SpaceX. As of March 31, 2013, NASA had paid $576.9 million to SpaceX under the CRS contract. Specific mission pricing data for the CRS contracts are considered Sensitive but Unclassified (SBU) based on procurement-sensitive information. The CRS contracts provide commercial fixed-price services in a competitive environment, and include not only the total amount awarded to date but also detailed pricing for the many different elements that are part of a task order for a mission. When additional task orders are added to the contract, the contractors are required to compete for the tasks using the detailed pricing in the base contract. Disclosure of the detailed pricing of each contract would impact the contractors' competitive positions and pricing strategies for future task orders. To maintain fair competition under the CRS contract, it is essential that NASA protect the commercial pricing aspects under the contracts by designating them SBU.

Question. Please provide a copy of the flight manifest for Space X CRS flights 1- 6, and the specific tasks, which have been paid for by the current $554 million dollars provided to Space X (as of the end of February, 2013), listed by cost for each task.

Answer. As of April 9, 2013, all mission milestone payments had been paid for successful completion of SpX-1 and SpX-2 missions delivering cargo and experiments to the ISS, with the exception of the final payment for the SpX-2 post-flight review report.

SpX-3 had completed five milestone payments, including the Authority to Proceed (ATP), Vehicle Baseline Review (VBR), Mission Integration Review (MIR), Flight Releasable Attachment Mechanism (FRAM), and the External Integration Review (EIR).

SpX-4 mission had completed four milestone payments including the ATP, VBR, FRAM, and the MIR. SpX-5 mission had completed two milestone payments including the ATP and VBR, and SpX-6 mission received ATP and is scheduled for VBR in May 2013.

SpaceX's flight cargo upmass capability is noted in the table below. Not included in the table are the upmass values for packing materials and various shipping containers. Cargo is also limited by its size with volumetric constraints in packing cargo.

Crew Supplies include food, crew provisions, photo/television, Operations Data File (ODF) and crew care packages. Utilization includes utilization outfitting (racks) and utilization resupply. Vehicle Hardware includes corrective maintenance, preventive maintenance, consumables resupply, pre-positioned spares and assembly hardware, avionics, and Crew Health Care System (CHeCS). Computer Resources includes all U.S. On-orbit Segment (USOS)

Table 2: Pressurized Cargo Breakout
(mass in kg)

Flight	Pressurized Cargo Capability	Research Utilization Experiments	Crew Supplies	Vehicle Hardware Items	EVA Tools	ISS Computer Supplies	Contingency Maintenance Supplies	Unpressurized Cargo Plan
SpX-1[6]	440	149	105	102	0	3	81	none
SpX-2[6]	578	340	92	135	3	8	-	Grapple bars
SpX-3	1,256	622	193	275	25	15	126	HDEV & OPALS
SpX-4	1,244	708	258	137	120	45	(24)	RapidScat
SpX-5	1,256	705	302	157	25	62	5	CREAM
SpX-6	1,256	681	407	108	30	30	-	SAGE & MUSES

Acronyms:
HDEV - High Definition Earth Viewing
OPALS - Optical PAyload for Lasercomm Science
RapidScat is a scatterometer experiment
CREAM - Cosmic Ray Energetics and Mass
SAGE - Stratospheric Aerosol and Gas Experiment
MUSES - Multiple User System for Earth Sensing

laptops and support equipment. EVA includes all Extravehicular Activity hardware.

Contingency Maintenance has been allocated to protect for unforeseen maintenance needs.

SpaceX flights also provide downmass to return cargo, hardware and experiments. SpX- 1 returned 734 pounds (333 kg) of scientific materials, including results from human research, biotechnology, materials and educational experiments, as well as about 504 pounds (229 kg) of space station hardware. SpX-2 returned 2,668 pounds (1,210 kilograms) of science samples, equipment and education activities. SpX-3 through SpX- 6 are planning to return approximately 1,800 kg of cargo and experiments.

Question. The payment for CRS tasks through flight number 6, which is not yet scheduled, looks like a way to extend payroll support to a company, which has been dependent on the U.S. government for all but one of its flights so far. I am concerned about paying ahead for flights, which are so far out in the future. Moreover, by flight 12 you will run out of future tasks to which you can attribute early payments. What flight schedule are you insisting upon with Space X to ensure that the taxpayers receive these flights in a timely manner, and with no proposals by NASA to add tasks, which involve still further payments?

[6]ISS accepted a reduced capability on SpX–1 and SpX–2 and an equitable adjustment was negotiated.

Answer. NASA is pleased with the progress being made by its two Commercial Resupply Services (CRS) contractors, Space Exploration Technologies (SpaceX) and

Orbital Sciences Corporation (Orbital). Both contractors have developed flight hardware in preparation for these future flights. They have also completed analysis and design to accommodate different payloads and internal cargo on these flights. This hardware and work requires a significant lead time. NASA needed to begin work on these flights in order to insure the critical capability needed to support ISS research was available when required. NASA pays the contractors for the achievement of milestones, and if scheduled milestones are missed, the contractors provide consideration to the Agency, such as technical studies. As of April 2013, the scheduled launch dates for those CRS missions with Authority To Proceed (ATP) are shown below:

SpaceX

- **SpX-3** November 2013
- **SpX-4** April 2014
- **SpX-5** August 2014
- **SpX-6** TBD (launch window will be set in May)
- **SpX-7** TBD (launch window will be set in August)

Orbital

- **Orb-1** September 2013
- **Orb-2** December 2013
- **Orb-3** April 2014
- **Orb-4** October 2014
- **Orb-5** January 2015
- **Orb-6** TBD (launch window will be set in July)

Question. These first two contracts are years behind schedule. For any flight plans beyond the 12-flight contract with Space X and the 8-flight contract with Orbital Sciences, are you considering an open and full competition or are you planning to extend these contracts indefinitely? If you are planning an

open competition, how would you offset the subsidy-effect advantage enjoyed by Space X due to the early payment of hundreds of millions of dollars through the COTS program, and by CRS payments, and augmented by another $524.6 million in commercial crew payments and awards?

Answer. NASA can continue to award some additional flights under the current CRS contracts by competing additional task orders through the end of the contract in 2015. Beyond that, NASA would anticipate competing a new contract for future cargo servicing. It is important to note that the current CRS contractors have only received payments for milestones achieved.

Question. NASA awarded an upcoming science payload mission to Space X, manifested for a Falcon 9 rocket. There is speculation that NASA will not receive an existing Falcon 9 rocket (which has been certified for part of NASA's payload list), but rather a new version of the Falcon 9 rocket, which reportedly will have a different propulsion system and thus is not yet certified for NASA and Air Force missions. Can you please provide written verification that the rocket received will be the Falcon 9 in the configuration that has already been tested, and that these funds will not, instead, be used to subsidize the development of a new rocket by Space X?

Answer. In July 2012, NASA's Launch Services Program (LSP) awarded a Launch Service Task Order (LSTO) to Space Exploration Technologies (SpaceX) for the launch of the Jason-3 ocean topography science satellite. The LSTO was awarded under the NASA Launch Services (NLS) II contract. This contract vehicle is used to award commercial launch services for NASA payloads, not to perform launch vehicle development. SpaceX proposed to provide a Falcon 9 version 1.0 launch vehicle for the launch of Jason-3. The Falcon 9 version 1.0 is the version that has successfully completed five flights to orbit. Successful orbital flights are key, but are not the only requirements necessary to achieve certification for the launch of high value NASA Class A, B & C payloads. SpaceX efforts to achieve Category 2 launch vehicle certification of the Falcon 9 version 1.0 (as defined in NPD 8610.7D) are ongoing, with successful completion required prior to launch, which is currently planned for March 2015. The NLS II contract includes terms with all of our NLS providers that allow them to offer to substitute a different launch vehicle version or model for one that is part of an ongoing LSTO. For example, Lockheed Martin, with NASA's concurrence, used this NLS term to switch from the Atlas IIIB launch vehicle model to the Atlas V for the Mars Reconnaissance Orbiter mission that flew in 2005. It is possible that SpaceX may offer to switch from the Falcon 9 version 1.0 to the Falcon 9 version 1.1 for Jason-3. NASA would most likely consider acting on such an offer after the first successful flight of the Falcon 9 version 1.1. If such a

switch is offered, NASA LSP would review the terms of the offer and make a decision for acceptance or rejection based upon Agency best interests. Any substituted vehicle remains subject to the certification requirements of the contract.

Question. Please provide a detailed breakdown of all NASA FTE time provided by NASA civil servant personnel—outside of COTS and CRS funds—which were provided to Space X to assist in software problems, hardware problems, and on any other issues. What is the total dollar value of the employee time, and NASA facility time and other resources provided to Space X?

Answer. NASA budgeted and spent approximately $42.4M through March 31, 2013 for NASA's efforts to manage and support the commercial cargo development effort. This includes the cost of government facilities and NASA personnel expertise provided through the program office. However, NASA does not track the cost to support the individual providers, SpaceX and Orbital. Also, NASA does not track additional, indirect support provided for the cargo development effort by other Agency Programs such as ISS.

NASA's primary role is to monitor the progress of its commercial partners through an assessment of the milestones and to make payment for successfully completed milestones. NASA provides expert technical assistance; as requested or where considered necessary, via the NASA COTS Advisory Team (CAT) discipline experts drawn from across the Agency. CATs selectively support commercial partner reviews and consult on technical issues as requested. More extensive NASA support requires reimbursement for services, access to facilities and use of NASA property via Reimbursable Space Act Agreements and agreements under the Commercial Space Launch Act (CSLA). Commercial Partners also receive ISS integration and certification support for their visiting vehicles. NASA has spent $42.4M of the funds appropriated for the COTS program since 2006 managing and supporting the COTS effort of both commercial partners, and approximately $17.8M of that cost (through March 31, 2013) is NASA civil servant labor.

Question. Space X is, I understand, using some of its own funds to use and repair certain range facilities. What is the value of those ranges and facilities if a company had to build them or purchase them as a private enterprise? Please provide the same information for any other similar use-arrangement by other companies.

ANSWE 70: SpaceX is leasing Launch Complex-40 in Cape Canaveral Florida, which is a U.S. Air Force (USAF) facility. NASA is not aware of the value and/or costs associated with that facility or SpaceX's corporate funding amounts to repair/upgrade the facility. Regarding the range, SpaceX leverages various range services provided by the USAF, just as do all other

launch service providers operating from Cape Canaveral (e.g., United Launch Alliance). The USAF could provide an estimate of the cost of those services and the extent to which the launch service providers cover those costs.

Question. My understanding is that the commercial crew program was originally considered to be an option of the COTS program, to be determined after the cargo program proved it could take cargo to the ISS cheaper than previous programs. Is that correct?

Answer. The Commercial Orbital Transportation System (COTS) effort included an optional "Phase D" which would have facilitated commercial development of one or more crew transportation systems. Phase D was never funded and the criteria for funding it were never formally established by NASA.

Question. A total of $1.5B has been spent on commercial crew programs, or will soon be spent, in funds distributed through the commercial stimulus programs represented by the acronyms: CCDev1, CCDev2, CCiCap, and CPC. Three companies seem to be receiving significant funds to work on three different human spacecraft vehicles. Meanwhile, the U.S. has spent approximately $6B on the Orion crew vehicle, or various versions of it, which means we are working on four human spacecraft. As a Member of the Appropriations Committee, I am concerned that—in this time of budget austerity, canceled missions, and sequestration—we are funding four different human spacecraft. Meanwhile, we have spent $2B on the commercial cargo program and are only in the second flight of 20 flights, which were supposed to begin as early as 2009. I don't think we can enjoy the luxury of spending the requested $800M or more per year developing four human spaceflight vehicles, especially when the taxpayer owns no intellectual property in three of those projects. The idea of future savings is very much a speculation, even if there were plans to extend the International Space Station (ISS)

beyond 2020. In light of these delays and mounting costs wouldn't it make sense to terminate the current path and make a FAR-based, transparent award to assist one commercial crew provider, and a commitment for partial ownership by the taxpayer so that if the company and/or its key technology is sold to foreign competitors, the U.S. taxpayers will not lose those years of investment?

Answer. The requirements for a beyond-LEO vehicle like Orion are very different than the requirements for an ISS crew transportation vehicle. NASA is not developing overlapping capabilities as suggested in the question. NASA is in effect acquiring a vehicle and service for two very and distinct missions and capabilities. NASA is focused on developing the vehicle needed to support

its beyond-LEO missions and, at the same time, is fostering the development of a competitive marketplace of U.S. providers that will have the capability to provide access to LEO for both commercial and government customers. The goals for each of these activities are distinct and each addresses a different aspect of NASA's current mission.

Fostering the domestic launch industry to increase U.S. competitiveness in the global launch market will allow NASA to take advantage of a market with multiple launch providers. Maintaining competition for the Commercial Crew Program is critical to ensuring that NASA and the Nation receive the best value for future U.S.-based crew transportation to ISS. In addition, continued competition incentivizes that company to expand its commercial customer base by selling services to others or to take advantage of opportunities for efficiencies to support reasonable prices. Continued competition also incentivizes the companies to invest their own funds and share in the development costs of their CTS. Competition is the fundamental basis for establishing fair and reasonable pricing for all requirements. Having industry share in the cost of development and selling seats to other customers in addition to NASA will likely decrease NASA's costs for crew transportation services in both the short and long-term.

The Agency also believes the competitive environment provides strong incentive for the companies to make the investments needed to align their commercial offerings with NASA's certification requirements in order to remain competitive in the future certification and services phases. Having multiple companies competing against each other will help ensure the safest and most cost effective systems possible for the Government.

Regarding the concern related to intellectual property, under the CCiCap Space Act Agreements (SAAs), NASA is entitled to terminate an SAA if a provider misses a milestone and NASA determines that additional efforts are not in the best interests of the parties. If NASA terminates an agreement for the partner's failure to perform, NASA is entitled to exercise Government purpose rights in any technical data or inventions developed under the agreement. This allows NASA to use the data or inventions to continue the activity by or for the Government. Competition and having multiple providers is important in this overall strategy. If one company is unsuccessful, we can terminate and continue work with the others and still achieve our goals. NASA is still developing the procurement strategy for the Phase 2 contract of the Commercial Crew

Certification Contract. Future decisions regarding the handling of intellectual property for this phase of the program are still being developed.

Question. My understanding is that one commercial-crew proposal—combining engine technology already invested in, significant company cost-share, and a

lighter version of the Orion—was rejected. Instead, two proposals (one with 90% payment by the government, and another perhaps at an even higher taxpayer share) were awarded the commercial crew awards. Is there a financial penalty for failing to meet the deadline, other than supposedly bearing the remaining costs of completing the capsule? How much information about the criteria and the award-making is available to Members of Congress and their staff?

Answer. Please see response to question 72 above as it relates to the three proposals funded under CCiCap and recourse NASA has the option to pursue for missed milestones. NASA has posted online the Source Selection Statement from the CCiCap evaluation, which describes, in detail, the criteria used for the selection as well as the individual strengths and weaknesses of the CCiCap proposals.

Question. We cannot know the true cost of a commercial launch unless we figure in the significant benefits received from the expenditure of US government funds. How much money has been spent under the umbrella of SLS funding in CECR funds, and what is the value of that spending for commercial companies who will also be allowed to use these facilities?

Answer. The value of Construction and Environmental Compliance and Restoration (CECR) funds dedicated to support the SLS program in FY 2012 and FY 2013 is $260.7M. There are also $62.6M of CECR funds dedicated to upgrades at Kennedy Space Center to support Exploration Ground Systems (EGS). Coincidental benefits could ultimately accrue to the commercial companies from CECR funds allocated to support SLS-unique requirements; however, NASA is spending those funds directly to support SLS. NASA does have a separate $42.8M to support the 21st Century Space Launch Complex (21CSLC) initiative, which benefits multiple users (including non-Government users) of launch facilities.

Question. Space Policy Online raised some important questions about the Space X CRS flight 1. Has NASA launched an investigation into the effect of radiation on the Dragon capsule avionics, the magnitude of g-load forces experienced during re-entry, the accuracy of the landing site, and whether any of the to-be-returned biological samples were damaged or lost and why?

Answer. There was no need to launch an investigation into radiation effects on Dragon because observed rates were close to predictions. All radiation events were low impact except the Flight Computer B Single Event Effect (SEE) that caused the computer to re-set itself and not re-integrate with the remaining two flight computers. However, there was no adverse effect on the mission due to the fact that the remaining two flight computer strings

performed nominally. The SpX-3 vehicle software architecture changes will be in place on the next mission, allowing for a rapid flight computer re-sync should a flight computer take an SEE hit. While not required, this will be an added layer of redundancy not present in the current architecture.

The magnitude of g-load forces experienced during re-entry was within nominal prediction. Maximum acceleration during SpX-1 re-entry was 4.9 Gs. Dragon landed 1.5 nautical miles from the predicted splashdown location during SpX-1. This was within the limits of the expected splashdown zone. In calm seas, the recovery boat can travel that distance in minutes.

No biological samples were damaged or lost during the SpX-1 mission. The General Laboratory Active Cryogenic International Space Station (ISS) Experiment Refrigerator (GLACIER) freezer did lose power due to water intrusion but biological samples were not compromised. The water intrusion issue was fixed on SpX-2. The GLACIER freezer remained powered through the recovery process on SpX-2, verifying that the fix had worked.

It was reported that there were apparent radiation upsets during the Space X CRS-1 flight, which affected operations. Affected hardware included a flight computer, a GPS unit, propulsion and trunk computers, and an Ethernet switch. These are critical hardware components. Mike Suffredini (International Space Station Manager) recently reported that he thought Space X would go to rad-hard avionics, but it depended on whether it costs too much. All US critical avionics are rad-hard. ATV and HTV also have critical rad-hard avionics. NASA has always required rad-hard avionics components for safety critical avionics.

Question. How can Human Rating be achieved without assuring flight critical functions through rad-hard avionics components or equivalent measures?

Answer. Critical functions need to be assured in order to achieve commercial crew transportation system certification. Commercial Crew and ISS Program documentation does not define how each partner meets certification requirements; rather the partner is responsible for developing their verification closure strategies and NASA then approves these strategies as well as actual verification closure products.

Our partners have flexibility in developing verification closure strategies, including but not limited to system redundancy and/or radiation hardened components mentioned above in the question. Additionally, as part of their strategy, partners could choose to test non rad-hardened components and assemblies to ensure their functionality within nominal environmental constraints.

In any case, all critical functions and catastrophic hazard controls must be identified, controlled and verified by NASA or NASA's quality assurance agent

prior to achieving human rating certification and allowing NASA astronauts to fly on a partner's commercial crew transportation system.

Redundancy and bus architecture design can minimize the effect of radiation induced single event upsets. Further error detection and software correction algorithms can be added to avionics systems that correct for single event upsets. These design considerations as well as the specific application of the avionics can allow for hardware to be flown that is not radiation hardened. The avionics hardware does need to be tested to insure that permanent damage does not occur from radiation damage. For the cargo SpaceX Dragon capsule all of the design considerations and testing was completed and reviewed by NASA. SpaceX was required to prove that their design meet all fault tolerance requirements for approach and departure from ISS.

Question. Given that the change to rad-hard avionics is expensive, how does the increase in cost affect NASA costs and the Space X business case?

Answer. In terms of the CRS cargo contracts, NASA is paying a fixed price for a certain amount of upmass and downmass. Should SpaceX decide to use rad-hard avionics in its cargo vehicles, the cost to NASA would not be affected. Regarding potential future crew transportation services, SpaceX is held to the same safety standards as are other potential vendors, and they would have to determine how to incorporate costs into a potential contract bid. NASA cannot comment on how SpaceX's business case might be affected. The basic avionics design can accommodate radiation induced single event upsets without compromising safety. SpaceX was required to show that they could safely operate in the region near ISS with electronic components that were not certified to be radiation hardened. SpaceX conducted radiation testing to show that the electronic components would not hard fail when exposed to the space radiation environment.

Question. If this is not addressed, and based on Mike Suffredini's comments, it is a Space X decision, how does NASA justify this double standard as applied to Space X?

Answer. In terms of the CRS cargo contracts, NASA is paying a fixed price for a certain amount of upmass and downmass. Should SpaceX decide to use rad-hard avionics in its cargo vehicles, the cost to NASA would not be affected. Regarding potential future crew transportation services, SpaceX is held to the same safety standards as are other potential vendors, and they would have to determine how to incorporate costs into a potential contract bid. NASA cannot comment on how SpaceX's business case might be affected. The basic avionics design can accommodate radiation induced single event upsets without compromising safety. SpaceX was required to show that they

could safely operate in the region near ISS with electronic components that were not certified to be radiation hardened. SpaceX conducted radiation testing to show that the electronic components would not hard fail when exposed to the space radiation environment.

Question. I'm interested in the decision process that was used to overcome the Dragon capsule uncontrolled tumble in CRS Flight 2. Was the new computer code tested for compatibility with the existing code before "beaming it up"?

Answer. All the commands used to resolve the anomaly were already part of the approved and tested set of commands available to the operators. The commands were sent in series following standard, albeit accelerated, released mission procedures. The result of this process was essentially the same as if a tested and verified software patch was sent to the vehicle. However, a patch was not required because contingency procedures already existed for this type of valve issue.

Question. Is there any assurance the new code won't interfere with other critical elements of the original computer code and create unintended consequences?

Answer. Because all the commands used and available to the operators were already part of the original computer code, they were tested during the mission preparation verification and simulation activities, and hence there was no risk that they could interfere with other parts of the code.

Question. How was the code approved before "beaming it up"? I understand the vehicle was in a severe tumble; did SpaceX beam up the new code or did they receive help? If so, who else was brought in to help? Who paid for this help?

Answer. The vehicle was never in a severe tumble state during any part of the SpX-2 mission. The vehicle was tumbling at a rate of 0.5–0.7 deg/sec while working through the contingency procedures. These rates fall within typical slew rates and did not prohibit required vehicle commanding.

Dragon entered into a passive abort state after the anomaly was detected and in this state, auto sequence events such as solar array deployment and the first co-elliptic burn are not initiated. At this point in time, the mission operators and engineers assessed the situation and began to follow released contingency procedures to attempt to bring the vehicle back to its nominal state of health. Operators sent manual commands to Dragon to deploy the solar arrays and to pulse the valves, bringing the propulsion system back online. These commands were sent a few times in some cases because there wasn't always a strong signal lock due to the vehicle tumble rates. Repeat

commanding can also occur during nominal free-flight parts of the mission for the same reason. All commands were acquired by the vehicle within seconds or minutes and the delays did not adversely affect the mission.

SpaceX followed its contingency procedures, which had been approved and verified before flight by SpaceX and NASA after extensive testing, simulation, and review.

SpaceX handled all the communication by itself by utilizing the pre-planned assets for the mission. SpaceX did, however, request additional and extended support to the ground stations' organizations already in use (e.g. Air Force Satellite Control Network, SpaceX- owned stations, third-party stations) and handled the financial aspect within the mission agreements already in place.

Question. Do you believe that there exists a correlation between cost and safety when developing crewed launch systems, and if so, do you think that managing for low-cost solutions and profit could negatively impact crew safety in commercial crew systems?

Answer. With regard to human spaceflight systems, the commercial crew systems will have to meet the same or equivalent safety requirements as NASA's deep space human spaceflight systems (i.e., SLS and Orion).

Question. Please provide a list of all climate-change related research at NASA and what SMD budget accounts in which they occur, for Fiscal Year 2012 and Fiscal Year 2013.

Answer. The climate change related research at NASA, as well as research in other areas of Earth science, is conducted within the following SMD budget accounts:

- Earth Science Research and Analysis
- Earth Systematic Missions
- Earth System Science Pathfinder
- Earth Science Multi-Mission Operations

Question. How many NASA-funded personnel (broken down by civil servants and contractors) work at a rate of 0.5 FTE (or greater) per year on climate-change related research and support work? How many of these are U.S. citizens?

Answer. In FY 2013, over 600 NASA Civil Service employees are estimated to have worked more than half-time on Earth Science activities that address, or

will address, global climate change. This estimate includes work on satellites yet to be launched, as well as spacecraft operations and actual research. The estimate also includes scientists, engineers, and administrative personnel. Only four of these employees are believed to be non-U.S. citizens.

Approximately eight times as many (on the order of 5,000) contractors and grantees, including but not limited to aerospace industry employees, university scientists and on- site support contractors, are estimated to work on the same programs. Precise numbers are difficult to obtain because of the vast numbers of contracts and grants that are constantly in flux. Because the population of contractors and grantees is ever changing, it is not possible to provide information about citizenship status of this population.

Question. Please list by Center the number of employees (broken down by civil servants and contractors) badged at each NASA Center for FY 2008, FY 2012, FY 2013, and proposed for FY 2014.

Answer. The following table displays data for civil servants and on-site contractors at NASA Centers (including contractors with on-site access to NASA Centers). Data for FY 2008, FY 2012 and FY 2013 is drawn from the Identity Management and Account Exchange (IdMax), NASA's system for tracking secured identities and credentials, including physical access badges. The data are current as of April 10, 2013, and represent actual badged individuals (head counts). Please note that the data available for FY 2008 cannot be fully verified due to challenges associated with transitioning data from previous multiple systems into the newly centralized IdMAX system that year.

Note: The FY 2014 projections for NASA civil servants represent civil service full-time equivalents (FTEs) and are aligned with the President's FY 2014 budget submit. NASA does not project number of contractor personnel; therefore, contractor data is not included for FY 2014.

Table 3: Civil servants and on-site contractors at NASA Centers

Center on Badge	**Badge Type**	**Fiscal Year**			
		2008	**2012**	**2013**	**2014**[7]
ARC	Civil Servant	1,213	1,124	1,210	1,200
	Contractor	1,129	2,430	2,608	
Total, ARC		2,342	3,554	3,818	
DFRC	Civil Servant	540	740	545	551
	Contractor	438	936	746	
Total, DFRC		978	1,676	1,291	

Table 3: Civil servants and on-site contractors at NASA Centers

Center on Badge	Badge Type	Fiscal Year			
		2008	2012	2013	2014[7]
GRC	Civil Servant	1,581	1,691	1,610	1,595
	Contractor	1,709	1,664	1,912	
Total, GRC		3,290	3,355	3,522	
GSFC	Civil Servant	2,907	3,120	3,364	3,331
	Contractor	3,774	8,811	9,175	
Total, GSFC		6,681	11,931	12,539	
HQ	Civil Servant	1,278	1,297	1,276	1,155
	Contractor	653	1,061	1,049	
Total, HQ		1,931	2,358	2,325	
JPL	Civil Servant	0	0	0	0
	Contractor	2,644	3,995	7,160	
Total, JPL		2,644	3,995	7,160	
JSC	Civil Servant	3,072	4,235	3,148	3,098
	Contractor	12,438	9,867	10,496	
Total, JSC		15,510	14,102	13,644	
KSC	Civil Servant	1,942	2,093	2,062	2,025
	Contractor	11,140	4,851	6,583	
Total, KSC		13,082	6,944	8,645	
LARC	Civil Servant	1,783	1,866	1,859	1,881
	Contractor	1,545	2,453	2,170	
Total, LARC		3,328	4,319	4,029	
MSFC	Civil Servant	2,428	2,337	2,420	2,407
	Contractor	5,400	5,683	6,075	
Total, MSFC		7,828	8,020	8,495	
NSSC	Civil Servant	105	143	139	142
	Contractor	266	321	462	
Total, NSSC		371	464	601	
SSC	Civil Servant	250	291	309	313
	Contractor	1,315	1,621	1,527	
Total, SSC		1,565	1,912	1,836	
All Centers	Civil Servant	17,099	18,387	17,945	17,698
	Contractor	42,451	43,693	49,963	

Table 3: Civil servants and on-site contractors at NASA Centers

Center on Badge	Badge Type	Fiscal Year			
		2008	2012	2013	2014[7]
Grand total		59,550	62,630	67,905	

Question. How many NASA employees report to the NASA Headquarters building each week as their primary work location, broken down by FY 2008, FY 2012, FY 2013, and proposed for FY 2014?

Answer. The following data, based upon weekly payroll records maintained by the Office of Headquarters Operations, reflect NASA Headquarters personnel reporting to the Headquarters facility, including NASA employees working in the Office of the Inspector General and NASA detailees on loan from other NASA Centers. Given the variability in the weekly data over time, the figures represent an estimated weekly total for each of the requested fiscal years.

The FY 2014 projected weekly number of NASA personnel reporting to the Headquarters facility is based on workforce projections associated with the President's FY 2014 budget submit.

Table 4: NASA personnel reporting to the Headquarters facility

FY 2008	1,356
FY 2012	1,315
FY 2013	1,269
FY 2014 (projected)	1,234

Question. How much cost-savings do you anticipate in FY 2013 through your restrictions on NASA civil servant and contractor travel in response to sequestration?

Answer. NASA anticipates we will eliminate approximately $10M in NASA civil servant and contractor travel as a result of sequestration.

NASA has been complying with Executive Orders 13576—Delivering an Efficient, Effective and Accountable Government, and 13589—Promoting Efficient Spending. Under these orders, NASA has set a FY 2013 cap on civil servant travel of $80M (a 20 percent reduction from FY 2010 levels, and identical to the FY 2012 cap). As of May 31, 2013, NASA has spent $9.3M

[7]Projection

less on civil servant travel than in FY 2012, a reduction that is attributable to the impact of the sequester.

Question. Both NSF and NIH are participating in the Administration's "Big Data" Initiative. Given all of the data-intensive research that NASA does in engineering, space science, and atmospheric science, is NASA participating in the Administration's "Big Data" Initiative?

Answer. NASA is an active participant in the White House's Big Data R&D Initiative, which is being led by the Networking and Information Technology Research and Development (NITRD) Program. Examples of NASA participation in the Big Data Initiative include:

- Participation in the formulation and proposal evaluation of a 2012 Announcement of Opportunity issued by the NSF. The work solicited in this research opportunity is primarily at an earlier stage of research than NASA invests in; however, NASA continues to evaluate the results of this research for applicability to NASA's mission objectives.

- NASA takes an active role in the Domain Research Projects area, where specific research projects that involve the use of big data and interagency collaboration are being evaluated to identify common data infrastructure challenges that would benefit from additional research. Specific examples of reviews include the evaluation of the Health Effects of Climate Change and the Materials Genome Initiative. NASA is also very involved in a variety of interagency big data efforts in Earth Science.

- NASA has been a leader in the Prizes and Challenges area–several interagency prize competitions sponsored by NASA have been conducted, with help from other agencies to perform evaluations and to judge the contests. These competitions have resulted in a number of innovative ideas that are being explored more thoroughly under the initiative.

Question. I am told that there are refereed, peer-reviewed publications showing that climate models over the past 35 years are running significantly warmer than the actual observations. This would raise serious questions for the Congress about how well the Earth's complex climate system is actually understood, with implications on the scientific basis for energy policy as well as for assessing how our national policy might realistically impact the Earth's climate in a desirable way. What is NASA doing to better understand why the most widely-used climate models are not able to reproduce the actual climatic

observations, particularly those made from space? What role does NASA play in assessing the agreement of various climate models with observed climate data, and what steps does NASA take to ensure that the scientists who are involved in measuring the agreement between the models and the data had no role in developing the models? What steps does NASA take to ensure that all expert perspectives, including those that might call into question popular theories, are considered in developing, executing, and assessing your agency's current climate change programs? What metrics can you present to demonstrate that the development, execution, and assessment of NASA's climate change research programs includes all expert perspectives, including those that may not agree with or support the most popular climate system theories?

Answer. The President's budget request for NASA's Earth Science Division supports a wide range of activities aimed at providing a broad suite of precise, global observations; improving our detailed understanding of the Earth system; and combining the observations and understanding to develop and test applications that provide direct societal benefits. The Earth system is complex, comprising many different processes with differing space and time scales and which are all mutually interacting. Each specific Earth system model, including climate models, has its own strengths and weaknesses; indeed, detailed comparisons of differences between models, and between models and observations, is a key method that was used to inform the President's budget request by identifying the research areas requiring additional focus.

NASA continues to devote resources specifically to the evaluation of Earth system models by comparison with the high quality, global measurements obtained from the nation's Earth observing research satellites. In just one example, the President's FY 2014 budget request provides funds to continue the successful "Obs4MIPS" pilot project focused on characterizing, preparing, and distributing NASA (and other-agency) satellite data sets so that they can be used efficiently to evaluate climate models. Established jointly by NASA and the Department of Energy, the Obs4MIPS activity is specifically designed to improve the connection between data experts and scientists involved in climate model evaluation.

All of NASA's Earth observation data products are freely and openly available to anyone over the Internet. All of NASA's Earth Science research solicitations are similarly broadly advertised and available to any potential proposer through electronic and hardcopy means. The solicitations state explicitly the evaluation criteria that are used in the Agency's review—the important criteria related to scientific aspects focus on the analysis techniques to be used in the investigation, not on the specific results and conclusions that will only be obtained when the work is completed. All of NASA's Science Mission Direc-

torate proposal evaluations and selections, including those of the Earth Science Division, are conducted, documented, and reviewed by the highest standards of peer review and in accordance with all Federal laws as well as Science Mission Directorate rules and policies (see `http://science.nasa.gov/media/medialibrary/2012/07/24/SMD_Peer_Review_Policy.pdf`; note that the SMD policy also specifies that "each proposer shall be provided with the findings that formed the basis for the acceptance/rejection of the proposal," and the processes provide for a debrief if requested by a proposer).

As one element of NASA's response to the Government Performance and Results Act Modernization Act (GPRAMA) of 2010, the entire suite of NASA Earth Science Division research activities and results is assessed in detail by the independent Earth Science Subcommittee (ESS) of the NASA Advisory Council, in one or more public meetings conducted according to the Federal Advisory Committee Act (FACA). All of the Committee's deliberations are public, and the ESS written report identifies strengths as well as deficiencies in the Earth Science research program, in addition to describing the Committee's analysis methodology.

Questions for the Record—Mr. Serrano

Space Grant Funding

I believe that educational programs are an important part of our government's science- related agencies. In particular, it is essential that we maintain those programs with a high participation of students from underrepresented communities. The Space Grant Program is one such program.

Question. In the past there has been a base level of funding for each consortium, with a subsequent augmentation. Of course, all agencies and programs have been dealing with the sequester, but it has come to my attention that the grantees and consortia have had a difficult time operating their programs with the uncertainty around their budget. Can you explain the funding model for this program?

Answer. NASA continues the base-funding model for Space Grant established in 2010. All consortia continue to receive base award funds in alignment with their established multi-year (2010–2014) grant awards. In order to fully obligate all FY 2012 funds, the NASA Office of Education forward-funded a certain number of consortia for their Year Four Statement of Work. In FY 2013, consistent with the Space Grant legislation, additional program funds (above fully funding the remainder of the base awards) are competitively awarded. All consortia are eligible to compete for those funds.

WEDNESDAY, MARCH 13, 2013.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OVERSIGHT OF THE INSPECTOR GENERAL

WITNESS

PAUL K. MARTIN, INSPECTOR GENERAL, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

OPENING REMARKS OF CHAIRMAN WOLF

Mr. WOLF. The hearing will come to order.

The reason we postponed it for an hour was because there was a group of us testifying on the FBI relocation at the T&I Committee.

I want to welcome everyone to today's oversight hearing on management challenges at the National Aeronautics and Space Administration.

Our witness is Mr. Paul Martin, the NASA Inspector General.

NASA is facing a uniquely challenging moment in its history. The agency's strategic direction is poorly defined. Its budget is severely constrained, and its leaders confront a host of intractable management issues, including cost and schedule overruns, a surplus of unnecessary infrastructure, and difficulties with financial management.

Even more concerning, there is a growing body of evidence to suggest that NASA is confronting an agency-wide problem with protecting the security of its sensitive technologies.

The governments of China and other countries of concern are waging a sustained attack on NASA using multiple means and capitalizing on NASA's relatively weak internal enforcement of export controls.

In fact, in a report I just saw this morning, cyber attacks are a leading threat to the U.S., intelligence leaders said for the first time on Tuesday. Cyber attacks and cyber espionage have supplanted terrorism as the top security threat facing the United States.

That stark assessment came from an annual world-wide threat brief that cover concerns like North Korea's belligerent serious civil war and was reinforced with remarks by the spy chiefs before the Senate Intelligence Committee.

We are talking to a large extent about China and, yet, at times it looks like NASA is on a different page than the White House and all the top intelligence people.

I believe this is an area that NASA's management at all levels, including the IG—and I have been disappointed with the IG at times in some of these cases—should address more aggressively, and we tend to press our witness on that.

In a moment, we are going to begin with some brief opening remarks from Mr. Martin, who will then have questions from the subcommittee. But first I would like to recognize Mr. Fattah, the ranking member.

OPENING REMARKS OF RANKING MEMBER FATTAH

Mr. FATTAH. Thank you, Mr. Chairman.

First and foremost, let me welcome the witness and thank the chairman for holding this hearing. I think it is a very important hearing and timely.

I share the chairman's concerns around the cyber security and the national security issues related to the attacks on the computer systems at NASA and some of the other security issues that I am sure will be delved into.

I separate myself from the chairman in the sense that I think that this is an extraordinary period in NASA's distinguished history.

I was at the Jet Propulsion Laboratory on the occasion of the Curiosity landing on Mars after an eight and a half month trip. It was an extraordinary fete.

And the work that has been done to integrate the commercial crew efforts along with continuing the work on an eventual Mars mission in terms of human flight, none of which would have been possible without the chairman's very significant efforts to make sure that even in tight budget years, that NASA is adequately funded.

So I welcome you today. I know you have a difficult job in terms of oversight and we share in that responsibility of oversight. And so we will be able to learn from you about the challenges and issues that you have been dealing with.

And I thank the chairman, and I will add any other comments for the record.

Mr. WOLF. Thank you, Mr. Fattah.

Pursuant to the authority granted in Section 191 of Title 2 of the United States Code and clause 2(m)(2) of House Rule XI, today's witness will be sworn in before testifying.

Please rise and raise your right hand.

[Witness sworn.]

Mr. WOLF. Let the record reflect the witness answered in the affirmative.

Mr. Martin, your written statement will be made part of the record. You may proceed and summarize as you see appropriate.

Mr. MARTIN. Thank you, Mr. Chairman and Ranking Member Fattah.

TESTIMONY OF INSPECTOR GENERAL MARTIN

The successful landing of the Curiosity Rover on the surface of Mars in August energized the public about NASA's activities in a way not seen since the final Space Shuttle flight.

Similarly, two successful commercial resupply missions to the International Space Station by SpaceX are major steps forward and one of the agency's most high-profile, high-stakes initiatives.

However, NASA continues to face significant challenges including the need to reprogram funds to address cost overruns in the James Webb Space Telescope. This shift contributed to delays in several ongoing projects and the cancellation of others including one with the European Space Agency for planned science missions to Mars.

At the same time, NASA is busy developing a new rocket, capsule, and related launch infrastructure to enable crewed missions to an asteroid or Mars, expensive and technically complex undertakings in an increasingly austere budget environment.

Indeed, from our perspective, declining budgets and fiscal uncertainties present one of the most significant external challenges to NASA.

My written statement discusses our complete list of management and performance challenges. This morning, I plan to briefly highlight three.

First, project management. Over its 50–year history, NASA has been at the forefront of science and space exploration. However, in addition to their many achievements, many NASA projects share another less positive trait. They cost significantly more to complete and take much longer to launch than originally planned.

Last September, the OIG issued a report that identified four primary challenges facing NASA as it seeks to achieve project cost, schedule, and performance goals. These include the agency's culture of optimism, underestimating technical complexity, funding instability, and limited opportunities for project managers' development.

Second, IT security. One year ago, I testified before the House Subcommittee on Investigations about the state of NASA's IT security. Among other things, I mentioned at the time that only one percent of NASA's laptop computers were fully encrypted compared to a government-wide average at the time of 54 percent.

Eight months after that hearing, an unencrypted NASA laptop containing personally identifiable information on more than 40,000 individuals was stolen from the vehicle of a NASA employee. Agency officials estimate that credit monitoring and other expenses related to the theft could cost NASA up to $850,000.

Following that incident, the NASA administrator accelerated the time table for encrypting the hard drives of all agency laptops. And as of this week, they reported an encryption rate of 99 percent.

More broadly, however, our audits and investigations continue to identify recurring weaknesses in NASA's IT security program, including an inability to deter particularly sophisticated cyber attacks known as advanced persistent threats.

And, finally, NASA's aging infrastructure. Eighty percent of NASA's 4,900 buildings are more than 40 years old and beyond their design life. However, NASA has not been able to fully fund required upkeep and maintenance costs and estimates its deferred maintenance expenses at $2.3 billion.

One way NASA could reduce these costs is to reduce the amount of unneeded infrastructure in its inventory. To be successful, NASA must move beyond its historic "keep it in case we need it" mind set.

In an audit we issued earlier this month, the OIG identified 33 facilities, including wind tunnels, test stands, airfields, and launch-

related infrastructure, that NASA was not fully utilizing or for which NASA could not identify a future mission use. These facilities cost the agency more than $43 million in upkeep costs in fiscal year 2011 alone.

In closing, the National Research Council concluded in its December report that there is, and I quote, "A significant mismatch between the programs to which NASA is committed and the budgets that have been provided or anticipated."

In other words, too many programs are chasing too few dollars. I hope that the NRC's report together with the ongoing work of the OIG and the GAO will contribute to a dialogue about NASA's future priorities and lead to enactment of a realistic budget that will enable the agency to accomplish its multifaceted mission.

Thank you very much.

[The information follows:]

Testimony before the Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations

U.S. House of Representatives

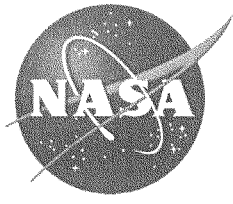
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Oversight of the National Aeronautics and Space Administration

Statement of

Paul K. Martin

NASA Inspector General



Chairman Wolf, Ranking Member Fattah, and Members of the Subcommittee:

The Office of Inspector General (OIG) is committed to providing independent, aggressive, and objective oversight of the National Aeronautics and Space Administration (NASA), and we welcome this opportunity to discuss the major challenges facing the Agency.

The successful landing of the Curiosity rover on the surface of Mars in August energized the public about NASA's activities in a way not seen since the final Space Shuttle flight. Similarly, commercial resupply missions to the International Space Station (ISS) in October and again earlier this month by Space Exploration Technologies Corporation's (SpaceX) marked a milestone toward NASA's goal of fostering development of a commercial space transportation capability to low Earth orbit.

The past year was not without its challenges, however, including the need to reprogram funds from several Agency initiatives to accommodate cost overruns in the James Webb Space Telescope (JWST) and other projects. This shift contributed to developmental delays in several ongoing projects and cancellation of others, including a joint project with the European Space Agency for planned missions to Mars in 2016 and 2018.

Moreover, because NASA received less than half its requested budget for commercial crew development last year, the Agency extended to 2017 the earliest it expects to obtain commercial crew transportation services to the ISS – a date uncomfortably close to the Station's currently scheduled 2020 retirement. At the same time, NASA is moving forward with development of a new rocket, capsule, and related launch infrastructure to enable crewed missions to an asteroid, the Moon, or Mars – expensive and technically complex undertakings in an increasingly austere budget environment.

Declining budgets and fiscal uncertainties present the most significant external challenges to NASA's ability to successfully move forward on its many projects and programs. For the first 6 months of this year, NASA has operated under a continuing resolution that funds the Agency at last year's level of $17.8 billion. Moreover, NASA's share of the Government-wide sequestration cuts reduce that spending authority by $894 million.

Against this bleak budgetary backdrop, Agency managers continue to face significant challenges managing NASA's diverse portfolio of science, exploration, and aeronautics projects. Our 2012 report on the Top Management and Performance Challenges facing NASA identified five issues:

- The Future of U.S. Human Space Flight;
- Project Management;
- Infrastructure and Facilities Management;
- Acquisition and Contract Management; and
- Information Technology Security and Governance

A detailed description of these challenges and the work by our office examining each is contained in the Top Challenges document appended to this statement.

In my testimony this morning, I will highlight three issues: 1) project management; 2) information technology (IT) security; and 3) NASA's aging infrastructure.

Project Management

Over its 50-year history NASA has been at the forefront of science and space exploration and rightly takes credit for numerous scientific and technological discoveries and innovations. However, in addition to their significant achievements, many NASA projects share another less positive trait – they cost significantly more to complete and take much longer to launch than originally planned.

Last September, the OIG issued a report that examined NASA's project management practices and the primary challenges to achieving the Agency's cost, schedule, and performance goals. Cost and schedule increases on large projects like the JWST can have a cascading effect on NASA's entire portfolio. For example, in fiscal year (FY) 2012 NASA moved $156 million from other Science Mission Directorate projects and its Cross Agency Support account to cover cost increases in the JWST project. In addition, the Wide-Field Infrared Survey Telescope and several other missions have been postponed to make funding available for JWST. Moreover, as previously noted NASA has pulled out of an agreement with the European Space Agency on two future Mars missions and is reevaluating its Mars exploration strategy to accommodate a more restricted funding profile.

Our project management review identified four factors that present the greatest challenges to successful project outcomes at NASA: 1) the Agency's Culture of Optimism; 2) Underestimating Technical Complexity; 3) Funding Instability; and 4) Limited Opportunities for Project Managers' Development. The September audit report and the 2012 Management Challenges document discuss each of these factors in detail.

One of NASA's largest ongoing projects is its new "heavy-lift" rocket known as the Space Launch System or SLS. The NASA Authorization Act of 2010 set a goal for the Agency to achieve operational capability for the SLS and the accompanying Multi-Purpose Crew Vehicle (MPCV) by December 31, 2016. NASA's current plan is to launch an uncrewed test flight of the SLS and MPCV in 2017, followed by the first crewed flight in 2021.

Establishing realistic long-term budgets for the SLS, MPCV, and associated ground support programs is difficult, as illustrated by an August 2011 independent cost assessment for the program that concluded NASA's estimates are reasonable for near-term budget planning but do not support establishment of long-term budgets or detailed baselines. Constrained budgets also impact the pace of NASA's development efforts. For example, because the MPCV program is anticipating a "flat" budget profile for at least the next 10 years, NASA has adopted an incremental development approach that concentrates on systems needed to meet specific mission objectives for each test flight rather than an approach under which work on all MPCV systems progresses concurrently. The OIG is currently examining NASA's efforts to develop the MPCV and will continue to focus resources on NASA's launch and crew transportation development efforts in the years to come.

Information Technology Security

Just over a year ago, I testified alongside NASA's Chief Information Officer (CIO) before another House subcommittee about the state of IT security at NASA. I mentioned that at the time only 1 percent of NASA's laptop computers were fully encrypted compared to a Government-wide rate of 54 percent.

Last October, a NASA laptop containing the Social Security numbers and other personally identifiable information (PII) for more than 40,000 individuals was stolen from the vehicle of a Headquarters employee. Although the laptop was password protected, neither the laptop itself nor the individual files were encrypted. As a result of this theft, NASA contracted with a company to provide credit monitoring to the affected individuals and the Agency estimates that these services could cost up to $850,000.

Following the October 31 theft, the NASA Administrator accelerated the timetable to encrypt the hard drives of the Agency's laptop computers. As of March 8, NASA reported that it had encrypted 99.5 percent of Agency laptops identified as requiring encryption, had exempted 4,215 laptops from the requirement, and was determining whether another 375 laptops required encryption or also would be exempted.

NASA's portfolio of information technology assets includes more than 550 information systems that control spacecraft, collect and process scientific data, and enable NASA personnel to collaborate with colleagues around the world. Hundreds of thousands of NASA personnel, contractors, academics, and members of the public use these IT systems daily and NASA depends on them to carry out its essential operations. Overall, NASA spends more than $1.5 billion annually on its IT-related activities, $58 million of that for IT security.

Nonetheless, NASA remains a target of cyber intruders both because of the large size of its networks and because of the technical and scientific information it maintains. Over the years, NASA has increasingly become a target of a sophisticated form of cyber attack known as advanced persistent threats or APTs. The individuals or nations behind these APTs are typically well organized and well funded.

For example, our investigation of a series of APT attacks at the Jet Propulsion Laboratory (JPL) involving Chinese-based Internet protocol addresses between November 2011 and February 2012 confirmed that cyber attackers were successful in achieving control over much of JPL's network for several weeks and used this access to steal or attempt to steal NASA-funded data. While data theft appears to be the primary motive, the level of access gained by the intruders positioned them to have caused significant operational disruption had that been their goal.

Through our audits and investigations, we have identified systemic and recurring weaknesses in NASA's IT security program that adversely affect the Agency's ability to protect the information and information systems vital to its mission. In particular, the CIO's inability to ensure that NASA's mission computer networks implement key IT security controls continues to put these critical IT assets at risk of compromise. To illustrate, the Agency has not yet implemented two

recommendations from a May 2010 OIG audit report to monitor its mission networks for the presence of critical software patches and technical vulnerabilities.

Achieving the Agency's IT security goals will require sustained improvements in NASA's overarching IT management practices. Effective IT governance is the key to accommodating the myriad interests of internal and external stakeholders and making decisions that balance compliance, cost, risk, and mission success. Effective IT governance also helps ensure that public funds are efficiently spent by coordinating across NASA when purchasing IT products and services.

We are completing a review examining NASA's IT governance structure and anticipate making several recommendations for improvement. This audit is particularly timely given that NASA is currently seeking a new CIO.

NASA's Aging Infrastructure

NASA is the ninth largest Federal Government property holder, controlling approximately 4,900 buildings and structures with an estimated replacement value of more than $30 billion. In addition, more than 80 percent of the Agency's facilities are 40 or more years old and beyond their design life. Under its current policy, NASA is required to maintain these facilities either in an operational status or, if they are not being used, in sufficient condition that they do not pose a safety hazard. However, NASA has not been able to fully fund required maintenance costs for its facilities and in 2012 estimated its deferred maintenance costs at $2.3 billion.

One way NASA could reduce its facilities maintenance costs is to reduce the amount of unneeded infrastructure in its inventory. To be successful in this effort, NASA must move beyond its historic "keep it in case we need it" approach of managing its facilities. In an audit issued last month, the OIG identified 33 wind tunnels, test stands, thermal vacuum chambers, airfields, and launch-related facilities that NASA was not fully utilizing or for which Agency managers could not identify a future mission use. These facilities cost the Agency more than $43 million to maintain in FY 2011 alone.

We found that NASA's efforts to reduce its underutilized facilities have been hindered by several longstanding and interrelated challenges: 1) fluctuating and uncertain strategic requirements; 2) Agency culture and business practices; 3) political pressure; and 4) inadequate funding. To its credit, NASA is undertaking a series of initiatives aimed at "rightsizing" the Agency's real property footprint. However, we noted that many of these efforts are in the early stages and may ultimately be insufficient to overcome the cultural and political obstacles that have impeded past efforts to reduce unneeded infrastructure. Accordingly, an independent outside process similar to the Department of Defense's Base Realignment and Closure Commission may be necessary.

Leasing offers NASA another means to help address maintenance costs associated with its aging and underutilized facilities. However, Federal law and policy prohibit NASA from leasing facilities for which it has no current or future mission-related use. The Agency should consider other options for these facilities such as demolition or reporting the property to the General Services Administration for sale or transfer to another entity. The challenge for NASA is to use

leasing when appropriate to generate revenue to offset facilities operations and maintenance costs while not using it as a way to hold on to facilities it does not need.

Conclusion

The National Research Council (NRC) concluded in its December 2012 report that there is a "significant mismatch between the programs to which NASA is committed and the budgets that have been provided or anticipated." In other words, too many programs are chasing too few dollars. I am hopeful that the NRC's report, together with the ongoing work of the OIG and Government Accountability Office, will contribute to a dialogue between the Administration and the Congress about NASA's future priorities and lead to enactment of a realistic budget that will enable the Agency to accomplish its multifaceted missions.

We look forward to continuing our cooperative working relationship with NASA, this Subcommittee, and other congressional committees as we conduct audits and investigations that focus on the Agency's top management and performance challenges.

Mr. WOLF. Well, thank you.

The NRC report came out of the committee. And, secondly, I do agree with Mr. Fattah. And, thirdly, if you look at the numbers from the CR that will be voted on, the numbers that came out of the House are higher than the numbers that came out of the Senate.

THREAT TO NASA FROM CHINESE ESPIONAGE

And so if we are going to fund these programs, which I believe in deeply, we are not going to stand by and allow the Chinese and others to steal information from those programs.

And I should tell the members—and maybe I should have a briefing with the members—the number of career federal employees that are contacting my office is incredible.

I just got another one last night which I am not going to read into the record here. But I think maybe what I might do at an appropriate time is bring these career federal employees in to lay this on the record.

This is not something that I read about one day in a newspaper report. These people are coming into my office, some fearful, time after time. And when the one story broke, now more are calling from more centers.

So it is a problem, and I am not going to stand by. I am going to pursue this thing. And we are not going to fund these things if problems are not addressed.

I agree with the Administration. I appreciate the statement that Donilon, the National Security Advisor made in a speech up in New York yesterday or the day before. We are not just going to pretend it is not taking place.

You have a tremendous responsibility to aggressively pursue this and not blow it off. And some of the reports that we are getting from some of the career people is that when they are coming to some of your IG people at different centers, they just kind of blow them off.

So if this is not pursued, we are going to have a hearing and bring these people in. Some are willing to risk their jobs, others are afraid but they will come, to kind of lay it out. We are not going to argue to bring up these budget levels and make them as high as we possibly can while cutting other programs we may not want to cut, and then have the Chinese steal the information. They are not only stealing the technology, which is a threat to our national security, but they are stealing jobs.

To the Administration's credit, they laid it out finally, something that should have been done long ago by a previous administration. We are not going to stand for this.

This committee hopefully, though I can only speak for myself, will not stand for it or allow it to be taking place in any of the programs that are funded through the committee.

Some of this could lead to the death of Americans. So it is not just the technology and national security threat and a job issue, but the technology going into the wrong hands could lead to the death of Americans.

Maybe we should sit down with all the members and let them see what is coming in. The Chinese government currently presents

the most aggressive espionage and cyber threat to the United States, as we seen what Director Mueller, Director Brennan, and Director Clapper said yesterday.

As just one example of their level of activity, eighty-five percent of all trade secret espionage cases brought by the Department of Justice against foreign nationals since 2009 have involved Chinese nationals spying for Chinese institutions.

Although this spying takes place across many different technology disciplines, a White House report recently identified aerospace and aeronautics technology as a primary target of Chinese espionage.

This is unsurprising given the rapid pace of development in China's space program which may rival the U.S. for human spaceflight dominance in the 21st century. China's space program is controlled by its military, the Peoples Liberation Army. It is the same group that is doing all the cyber attacks and has demonstrated hostile intentions in the past including a 2007 anti satellite missile resulting in the creation of a large debris field that continues to threaten our space-based assets today.

Do you agree with this characterization of the threat posed by China to the U.S. generally and to NASA specifically?

Mr. MARTIN. I do.

Mr. WOLF. Despite the significance of the threat and the very insular nature of China's own technology programs, NASA continues to allow access by Chinese nationals to a number of its own activities.

For example, career federal employees gave us the names of 29 Chinese nationals without U.S. citizenship currently working as contractors at Langley alone.

How many Chinese nationals are working as contractors across the agency?

Mr. MARTIN. We have not researched that, but I believe in correspondence to Mr. Rohrabacher, a copy of which was provided to you and your staff, I believe there are over 200 Chinese nationals with access to various NASA facilities.

Mr. WOLF. Have we seen that? Has the committee seen that?

Mr. MARTIN. Your committee staff has, yes.

Mr. WOLF. And that was from?

Mr. MARTIN. I believe that was from the NASA Administrator's office or the Office of Legislative Affairs at NASA to Mr. Rohrabacher in response to his questions along the same avenue.

Mr. WOLF. China is one of eight countries designated by the State Department as countries of particular concern. The others are Burma, Eritrea, Iran, North Korea, Saudi Arabia, and Sudan, where the genocide continues. China has one of the closest relationships to the genocidal government of Sudan.

I was the first Member of the House to go to Darfur to see with my own eyes the genocide. The genocide in Darfur continues. Two point one million people died in a north/south effort and, yet, China invites Bashir, who is an indicted war criminal, to come. So they are a country of particular concern that is also aiding countries like Sudan.

How many foreign nationals from these others countries of concern are working as contractors across the agency?

Mr. MARTIN. I do not know that, Mr. Chairman.

Mr. WOLF. Can you look into that?

Mr. MARTIN. We could look into that, sure.

[The information follows:]

According to NASA's Office of International and Interagency Relations, 192 Chinese nationals currently work at NASA Centers. We have requested that NASA gather the figures for the other listed countries and provide them to the Subcommittee directly.

Mr. WOLF. My office has heard allegations from a number of NASA facilities, all career people, about poor security practices, including dissemination of information without proper export control reviews, inadequate security procedures for reviewing foreign nationals seeking NASA credentials, and a failure to appropriately supervise and regulate the access of approved foreign nationals to sensitive information.

At best, these allegations are indicators of a systemic lack of attention to security requirements. At worst, they are something more insidious.

Do you believe NASA, taken as a whole, has the appropriate agency culture of security?

Mr. MARTIN. I believe they do. They have very detailed procedures, export control procedures, security background procedures both at the Center level and at the Headquarters level. The problem is in the adherence and execution of these by the hundreds of people across NASA.

So I think the structure is there and there are a lot of different responsibilities from a lot of different groups, from the Office of Security at the Centers to the export control officers. There is a counterintelligence function at NASA and then there is a NASA Office of Inspector General. Each of us have our lanes and we work together on these issues.

While I think the apparatus and the policies are there, the question is how well they are executed on a day-to-day basis.

Mr. WOLF. The career people who have brought security related allegations to their local OIG office report to us that their claims were not adequately dealt with.

How do you respond to that assertion?

Mr. MARTIN. I respectfully disagree with that. If you are referring to the specific case at Langley that was brought to our attention by your staff last week, I think that was being handled appropriately.

There was consultation between the Inspector General's Office and the Office of Security at Langley beginning in December. And they sat down in a meeting in early January and decided that, for the present at least, that this would be handled as a security matter. And that is the way it proceeded.

NASA counterintelligence also was of that opinion. NASA counterintelligence does not work for me.

Mr. WOLF. That runs counter to what these people said. And I think we may have to bring them in and have a public hearing.

Mr. MARTIN. I would be pleased to have that conversation.

ALLEGATIONS OF SECURITY VIOLATIONS AT THE AMES RESEARCH CENTER

Mr. WOLF. We want to ask you about a particular set of security-related allegations from the Ames Research Center that your office investigated between 2009 and 2012. These were serious allegations that, if true, represent a violation of national security.

Why did it take so long to complete your investigation at Ames?

Mr. MARTIN. It was a very complicated investigation involving multiple agencies working with the U.S. Attorney's Office. I pushed as hard as I could. We were one participant in this multi-agency effort. There is also some coordination with the Department of State which is the agency that opines on IT—excuse me—ITAR related matters, some slowdowns over there as well. So it was frustratingly slow.

Mr. WOLF. We have been told that your office, as well as the prosecutor's office, changed personnel in the middle of the investigation.

Why did you switch investigators and do you believe that change could have affected the quality of the case?

Mr. MARTIN. Let me answer the second question first. No, I don't think it affected the quality of the case. In fact, I think it improved the quality of the case and the focus.

We changed supervisors out in that west coast office. And when the new supervisor came in, she took stock of her staff and switched agents on the case to bring better focus to the case.

I can't speak to why the U.S. Attorney's Office switched out their prosecutor. You would have to ask them.

Mr. WOLF. It has come to our attention that a computer being held as evidence in this case was damaged beyond repair and that all of your electronic copies of that computer's hard drive were also either damaged or lost.

Is that accurate?

Mr. MARTIN. Partly. We had access to this computer. We did not have physical control of the computer, but we had a copy of all the information on the computer. And we conducted our investigation based on all the information on that computer.

When we eventually went back to get the computer, the best evidence as they call it in the criminal world, we found out the agency that had the computer, it had been damaged.

Mr. WOLF. Did the loss of the evidence harm your case?

Mr. MARTIN. It did not.

Mr. WOLF. I am going to go to Mr. Fattah in a minute or two, but just to cover one or two issues on this line.

ALLEGATIONS OF SECURITY VIOLATIONS AT THE LANGLEY RESEARCH CENTER

As you know, I am extremely concerned about a specific incident from Langley which took place late last year. A Chinese national, Bo Jiang, was hired as a NASA contractor despite his ties to an organization designated as a counterintelligence entity of concern. He then violated multiple terms of his service agreement, including provisions requiring him to be escorted at all times, to be restricted only to publicly available information, and to receive no direct

funds from NASA. This culminated in his return to China in possession of NASA hardware and data.

When did the IG's Office at Langley first become aware of the security concerns about Bo Jiang?

Mr. MARTIN. Before I answer that, I am not sure all your facts are absolutely correct.

Mr. WOLF. Why don't you correct them then?

Mr. MARTIN. I would be happy to. There is an email—well, let me answer the question as far as when we first became aware of this. I think in mid-December, we first became aware of this.

And in consultation with the Office of Security who has, at Langley, who has the responsibility for clearing individuals' access working with export, and so we started a discussion there, had a meeting in early January. The take-away decision——

Mr. WOLF. How long had Bo Jiang been on the job?

Mr. MARTIN. I believe he had been—had access to Langley over a year.

Mr. WOLF. Over a year?

Mr. MARTIN. He had been cleared by the Office of Security at Langley for access, unescorted access according to emails that I reviewed provided by your—in a report that was provided first by your staff to me last week.

Mr. WOLF. Go ahead.

Mr. MARTIN. So he had unescorted access at Langley according to the Office of Security for nine months to a year.

Mr. WOLF. And was that appropriate?

Mr. MARTIN. I don't know. Determining whether or not a foreign national should have access to a NASA center and what restrictions should be on that access is up to the Office of Export Control and the Office of Security, not the Office of Inspector General.

Mr. WOLF. The Langley Office of Security Services wrote a full investigative report outlining the case against Bo Jiang.

When did your agent at Langley receive a copy of this report?

Mr. MARTIN. About two days after your staff gave me a copy of it. That is when we received a copy.

Mr. WOLF. He never had any indication?

Mr. MARTIN. He had conversations.

Mr. WOLF. You are under oath.

Mr. MARTIN. I am under oath.

Mr. WOLF. He had conversation. What does a conversation mean with respect to when he knew about this?

Mr. MARTIN. You are saying when do we receive a copy of the report?

Mr. WOLF. Well, when did he know about it and receive a copy of the report?

Mr. MARTIN. They discussed the concerns that the Office of Security had in early January and the decision was made for the Office of Security to pursue the review, the investigation. And if they came across anything that the Inspector General's Office would be in a better position to handle, they should get back in touch with us.

Mr. WOLF. Where is Bo Jiang currently located?

Mr. MARTIN. I don't know that. I would ask the Office of Security.

Mr. WOLF. It is my understanding, this is the last question, we are going to go to Mr. Fattah, that co-workers of Bo Jiang advocated for an exception to be made allowing him to continue working with NASA in spite of his repeated violations of the security provisions of his employment agreement.

Do you believe this attitude reflects an appropriate concern for agency security?

Mr. MARTIN. I don't know that the underlying statement is accurate. We just received the report a matter of days ago and we are going through the report ourselves.

Mr. WOLF. Mr. Fattah.

Mr. FATTAH. Well, first of all, let me reiterate that I share the chairman's concern about that we do a full review of where we are with these security issues.

And I generally have the perspective that, you know, if we are going to give foreign nationals opportunities to work in and around these NASA facilities that, you know, that should be done on a reciprocal basis where American scientists and engineers have the same kind of access in these other countries. And if they do not, I do not see why we——

Mr. WOLF. Would the gentleman yield?

I agree completely with my friend from Philadelphia.

How many NASA employees are on China facilities today?

Mr. MARTIN. I have no idea.

Mr. FATTAH. Yeah. Well, you know, generally the relationship should be reciprocal and have some benefit on both sides.

But from a security standpoint, I am very supportive of the chairman's concerns and appreciate the documentation that will be forwarded.

NASA STRATEGY FOR IMPROVED INFRASTRUCTURE MANAGEMENT

Let me move to this infrastructure issue because you have got an infrastructure that is valued at about $30 billion. You have this mind set that has been prevalent to, as you say, keep it in case you may need it which is prudent, I mean to some degree. But there is obviously opportunities where some of this infrastructure that has built up since, you know, over the last five decades may not be in NASA's future and some thought should be given.

And I know that the Congress asked that a plan be developed in terms of this and so this is—I mean, one of the issues during the fiscal challenges that the country is facing is—you know, I am a big supporter of making the investments we need to make, but we also need to shed whatever unneeded costs we can.

So, you know, I would be interested if you could talk about your review of this infrastructure issue and where you think we are at this point.

Mr. MARTIN. Right. I think this is an issue that has bedeviled NASA for years and years and years as these major programs like the Space Shuttle program, you are left with infrastructure that was necessary during the conduct of that mission, what do you do with it.

And NASA has been—they have had—they have gotten creative. They have done some leasing, but NASA is still saddled with vastly

more infrastructure and facilities than it frankly can maintain in a safe way.

And so unfortunately over the years, we have seen also a deterioration in the cross-agency support budget that primarily funds these facilities. And so we—that is what leads to the $2.3 billion in deferred maintenance.

And so I think NASA needs to be smarter. They need to do, as the Chairman indicates, be clear on their strategic mission and their focus and then ensure they have the facilities to meet that mission and focus.

And then they need to make the difficult call perhaps to either demolish or to lease or to give up some of these facilities that have no current mission need or no future mission need. And this is difficult.

Mr. FATTAH. Let me ask you this question. Do you believe that the strategy in place now or that is being put in place is an effective way to make some of these—to get to the decision package you would need to make decisions about what you need and what you do not need?

Mr. MARTIN. The process appears—the folks at NASA appear committed. They have a couple different initiatives ongoing now. It is going to take the concerted effort of the senior levels at NASA, the Administrator, and it is going to frankly take—there is a good bit of political push-back when you are talking about an arc jet or a wind tunnel or an airfield at someone's district being potentially excessed. And so there has to be that political will. These are very difficult decisions.

Mr. FATTAH. Thank you, Mr. Chairman.

Mr. WOLF. Thank you.

Mr. Culberson.

ALLEGATIONS OF SECURITY VIOLATIONS AT LANGLEY RESEARCH CENTER

Mr. CULBERSON. Thank you, Mr. Chairman.

Mr. Martin, as the Inspector General obviously you are interested in auditing the agency to make sure that our tax dollars are being spent wisely, to make sure that the agency complies with federal law and is carrying out the policies that the Congress sets out for it.

Mr. MARTIN. Yes, sir.

Mr. CULBERSON. Another essential part of your responsibility is in pursuing investigations of potential criminal violations.

Mr. MARTIN. That's correct.

Mr. CULBERSON. Yes, sir. And because that is the scope of your jurisdiction I believe, of any Inspector General, if a federal employee within the scope of your jurisdiction lies to you or misrepresents a fact or conceals evidence in the course of an official investigation conducted by your office, that is a violation of federal law that can be prosecuted by the U.S. Attorney.

It is subject to essentially the same thing as lying to an FBI agent, right?

Mr. MARTIN. Yes, sir.

Mr. CULBERSON. That is your experience——

Mr. MARTIN. Yes, it could be.

Mr. CULBERSON. I am particularly interested in the fact that you said that, in your opinion, the policies and procedures that NASA had in place were adequate to protect the agency against——

Mr. MARTIN. If fully executed, and if correctly executed.

Mr. CULBERSON. The problem was with individuals at NASA. In particular, in referring back to the Chairman's question.

Mr. WOLF. Sure.

Mr. CULBERSON. I want to ask follow-up on the—on the incident at Langley.

I heard you say that the first time that the Office of Inspector General became aware of this problem at Langley was in mid December and that the first meeting that you had took place in mid January.

Mr. MARTIN. Early January.

Mr. CULBERSON. Early January.

Mr. MARTIN. The 8th of January is my understanding.

Mr. CULBERSON. Okay. And there was apparently a report, if I may, sir, forgive me, there was apparently an investigative report outlining the case against this Chinese national and that you did not became aware of that report—

Mr. MARTIN. That we didn't receive the report until last week.

Mr. CULBERSON. Until last week.

Mr. MARTIN. That is correct.

Mr. CULBERSON. But how did you become first aware of this Chinese national working at Langley?

Mr. MARTIN. Well, again, my understanding, and my facts are not—I wasn't involved obviously hands-on in the case, that this individual was working for an organization that NASA contracted with and had been working or had access to the Center for close to a year working on a software or a coding project.

Mr. CULBERSON. And how did your office become aware of that in mid December?

Mr. MARTIN. I think—believe we got a call or—either directly or indirectly from some export control officials.

Mr. CULBERSON. Who were concerned because?

Mr. MARTIN. That is what I don't know.

Mr. CULBERSON. Okay.

Mr. MARTIN. Yes, that is one of the many questions that I have about these activities.

Mr. CULBERSON. Who in your office did the Office of Export Control contact?

Mr. MARTIN. Someone in our Investigations Division, I believe.

Mr. CULBERSON. And so when your office, because you do criminal investigations as well, becomes aware of a potential criminal violation, you open up a formal investigation?

Mr. MARTIN. We review the matter, that is right.

Mr. CULBERSON. Sure.

Mr. MARTIN. We may open a preliminary investigation. We may open a full investigation. I believe in this matter, the Headquarters investigative folks contacted our agents at the Langley Center.

Mr. CULBERSON. In mid December?

Mr. MARTIN. In mid-December. And then they coordinated with the Office of Security.

Mr. CULBERSON. At that point, an investigation is opened. Any other criminal investigation?

Mr. MARTIN. No, not until you have more facts.

Mr. CULBERSON. Yeah. But, I mean, you basically pursue it like any other law enforcement agency because essentially that is what you are is a law enforcement agency.

Mr. MARTIN. We are a law enforcement agency, correct——

Mr. CULBERSON. Okay.

Mr. MARTIN [continuing]. With 1811s.

Mr. CULBERSON. For example, one of the many things that concern me about this, as the Chairman, I know every Member of the committee is concerned about it, is that obviously you have got a pretty good case like of espionage.

And there is also language in the statute that Congress has enacted now several times that prohibits NASA from sharing information with, from cooperating with the Communist Chinese.

But I think it is important that we not have any illusions about who they are. They are Communist Chinese. Whatever they do is aimed at extracting as much information as they can from the United States for their own benefit.

Particularly when it comes to space exploration, the information that they steal from NASA is going to be used to help better target their intercontinental ballistic missiles on the United States. This is a really serious matter.

So, you become aware of a Chinese national that the Export Control Office is concerned enough to contact you about in mid December and the time, several weeks since the chairman's office has contacted you about this. Certainly you know more about what your office did in pursuit of what is obviously a very serious breach of security, a violation of federal law, and a probable criminal conduct.

Mr. MARTIN. Well, I think we——

Mr. CULBERSON. Tell us more detail. I mean, I am——

Mr. MARTIN. Sure.

Mr. CULBERSON [continuing]. Not getting a lot of detail here.

Mr. MARTIN. Okay.

Mr. CULBERSON. And you have known about this for some time.

Mr. MARTIN. No, we didn't know about this for some time. Let me back this up. First off——

Mr. CULBERSON. You personally knew for several weeks. The chairman's office told you.

Mr. MARTIN. Last week.

Mr. CULBERSON. Let me try to get, if I could, a better——

Mr. MARTIN. Sure.

Mr. CULBERSON [continuing]. Picture.

Mr. MARTIN. Last week, sir.

Mr. CULBERSON. Okay.

Mr. MARTIN. Last week. And let me back up. Your statement, there is a lot in that statement which I think was a question about a confirmed case of espionage.

Mr. CULBERSON. Okay. But it looks like——

Mr. FATTAH. Can we let the witness respond, please?

Mr. CULBERSON. Sure. Yes, sir.

Mr. MARTIN. I don't know that to be true. And, in fact, the people closest to the ground, the people who are charged with espionage cases within the NASA structure, there is a counterintelligence, they don't believe it is—my understanding is they don't believe it is an espionage case. They believe this is most appropriately—has been most appropriately handled as a security matter which is why the Office of Security is the group that did the investigation down at Langley.

Now, we are looking at their report as is the CI component of NASA, as is the FBI. We are all going to take a look at this report and drill down into it. And if there is anything for us, for the Office of Inspector General, within our lane, within our jurisdiction to aggressively investigate, we sure as heck will.

I don't want to give any illusions that the Office of Inspector General is in any way not stepping up to the plate and enforcing the conduct of NASA employees or the—in any way, shape, or form looking the other way while NASA's important information is going out the front door or the back door.

Mr. CULBERSON. Sure. I understand that. And I am trying to get an idea of the scope of your lane, the responsibility. One of our greatest frustrations in Congress is trying to make sure the laws that we pass are enforced.

Mr. MARTIN. Sure.

Mr. CULBERSON. There are a lot of agencies out there to do that. When it comes to a criminal violation, obviously that is the first responsibility of the arms of the federal law enforcement agencies, whether it be DEA, ATF, the Marshal Service, whoever they are, ultimately do an investigation, passing the information on if they think there is probable cause to the U.S. Attorney's Office. My good friend, Mr. Schiff, was a U.S. Attorney. It is a lot of complicated moving pieces.

I am just trying to get a handle on the scope of your lane——

Mr. MARTIN. Sure.

Mr. CULBERSON [continuing]. And responsibility. You have got a statute that says no interaction with China, no information exchanged, we are going to keep the Chinese out. The NASA Security Office is, therefore, obviously in part responsible for this.

I mean, it sounds like you all are sort of taking a passive role in this. I just do not understand.

Mr. MARTIN. No, absolutely not taking a passive role. Again, I think we need to unpack your question if, again, if it is a question.

Mr. CULBERSON. Sure. Just so we understand your lane.

Mr. MARTIN. When you say a law was passed to allow no Chinese, that is not what the law says. The law prohibits bilateral agreements, contracts with Chinese companies and Chinese government.

There is no law that I am aware of, and please, Mr. Chairman, correct me if I am wrong.

Mr. WOLF. Yes, but it also calls for notification and NASA did not notify when they should have notified, particularly on Langley. So there is a violation there, and a violation of the spirit, too.

Mr. MARTIN. Sure.

Mr. WOLF. And I would like you to ask, if the gentleman would yield further——

Mr. CULBERSON. Please.

Mr. WOLF. Basically I agree with my good friend, Mr. Fattah. If you could find for the record and call us today and we will put it in the record, how many NASA employees are now in Chinese facilities? Because you told us how many Chinese nationals are in NASA facilities, so how many Americans are in Chinese facilities? Can you find that out and call us by the end of the day?

Mr. MARTIN. I can try. Again, this is—he is talking about being outside my lane. This is sort of a big NASA question.

Mr. WOLF. Well, if you can find out, you can call.

Mr. MARTIN. I am going to ask.

Mr. WOLF. Yes.

Mr. MARTIN. Right. I will ask the Administrator.

[The information follows:]

According to NASA's Office of International and Interagency Relations, no NASA employees are working at China's space-related facilities.

Mr. WOLF. Yield back.

Mr. CULBERSON. Yes and you have been generous with the time, Mr. Chairman, and I will pass.

But talk to us, if you could, about how this investigation proceeded, talk to us about, if you could, what your office has done, and also I really would love to know what happened to the computer and to this individual. Talk to us about the investigation. What is your office doing and have you done since you first became aware of this?

Mr. MARTIN. Right. Again, I am happy to speak about this, what I know about this. I am not sure this is the appropriate forum because this is an ongoing matter that several different agencies including our own continue to look at in light of receipt of the investigative report from the Office of Security. So I would be hesitant to go into a good bit of details at this point.

Mr. CULBERSON. Maybe you can do it in writing.

Mr. MARTIN. I would be happy to chat with your staff. I would be happy to chat with you.

Mr. WOLF. Why don't you do that?

Mr. CULBERSON. If you would do that in writing.

Mr. WOLF. And if you would be in touch with Mr. Culberson.

Mr. MARTIN. I would be happy to.

Mr. CULBERSON. I will submit questions to you as well to be submitted in writing.

Thank you, sir.

Mr. WOLF. Good.

With that, Mr. Schiff.

Mr. SCHIFF. Thank you, Mr. Chairman.

LAPTOP ENCRYPTION AT NASA CENTERS

Mr. Martin, I wanted to talk with you about a couple issues, the first of which is of deep interest to many of my constituents out at JPL and that involve the loss of a NASA laptop that was stolen from an employee's locked vehicle. The laptop contained records of sensitive personally identifiable information for a large number of NASA employees. Evidently the number of individuals whose data may have been compromised has been growing.

Has NASA completed the assessment of the extent of the disclosures? Is there any indication that the personally identifiable information on the laptop has been utilized by anyone? Has there been any identity theft or any other result of the theft?

Mr. MARTIN. Mr. Schiff, my understanding is they—NASA has completed its examination, forensic examination of this laptop and, no, I think the answer is there has been no reported misuse or use at all in any way of the information, the PII on that laptop.

Mr. SCHIFF. Is there——

Mr. MARTIN. NASA is in a—excuse me—is in a cautionary mode with the credit monitoring service for the 30 or 40 thousand individuals.

Mr. SCHIFF. Is there any indication that whoever stole this laptop knew what was on it? Was it stolen because of the data on it or was it stolen because it was a laptop?

Mr. MARTIN. We don't know that. My assumption having been in this business for the last 15 or 20 years is that it was stolen because it was a laptop and because it was unfortunately mishandled by the employee.

Mr. SCHIFF. One of the things it revealed was how little data on laptops had been encrypted.

What steps have been taken and do you know to what extent that problem has been addressed?

Mr. MARTIN. Yes, I think it has. We raised the red flag on the issue a year ago when we testified. As I indicated in my opening remarks, one year ago at this point, only one percent of NASA's laptops have been encrypted compared to a government-wide average of 54 percent. I frankly find that shocking.

After the theft, it was on Halloween that particular theft of the laptop that you are speaking to, Mr. Schiff, the administrator accelerated the time table. And as we sit here today, I believe 99.4 percent of all NASA laptops are encrypted.

Now, there are—there is a subset of approximately 4,000 laptops that have received what are called waivers for particular reasons, either they don't have data on them or they are stationary or—and the biggest chunk of those are actually at JSC and they are configured to mirror the configuration that is on the International Space Station.

So they don't want to put the encryption software here because I don't believe they are encrypted up on the ISS.

Mr. SCHIFF. The theft of a laptop is a fairly low tech way to steal data.

What other steps is NASA taking to safeguard the personal information it collects from employees, contractors, and others?

As you might know, this is an issue that has been raised in the context of a lawsuit by several JPL employees over the government's collection of personal information pursuant to HSPD 12.

What can you tell us in terms of what other steps they are taking to protect personal information?

Mr. MARTIN. Well, it would be personal information and NASA generated information. I think—I couldn't agree more with the Chairman's remarks about what various people have been saying about the cyber security threat to the country, and I will say in particular, because I happen to sit here, in particular to NASA.

NASA has probably a quarter of all the public facing Web sites of any civilian agency, over 3,000 Web sites given its mandate under the Space Act to share information. And while you are achieving that mandate of sharing information, you are also providing a pretty huge attack surface for folks who want to attempt to penetrate and steal data.

And NASA has been the subject, a victim, rather, of many attacks over the years at JPL and at other Centers. I am proud, and I inherited this when I came three years, but the Office of Inspector General at NASA has one of the, I would say the most sophisticated and aggressive cyber security, we call it our Computer Crimes Division, units in all the Federal Government.

So NASA has taken a series of steps including creation of what they call a SOC, a security operations center, where they attempt to centralize all the information on cyber threats, according to NASA, but as we have pointed out in probably 20 or 30 audits and investigations over the last handful of years, NASA has a long way to go.

JAMES WEBB SPACE TELESCOPE

Mr. SCHIFF. Let me turn your attention to James Webb, if I could. I do not know how much you have been involved in the analysis of the cost overruns at Webb. I am a big believer in the science that will come out of Webb, but I am just incredibly distressed over the multiple cost overruns and the degree to which James Webb has sucked not only the oxygen but the money out of so many other important planetary science projects.

Can you give us a little sense of what you think led to such an extraordinary series of overruns, whether NASA has in place sufficient protections in the future to guard against this, and do you have any idea whether we have seen the end of the overruns at Webb because I continue to hear that we are not done yet in terms of the increasing fiscal toll of Webb?

Mr. MARTIN. Right. I wish I could give you a detailed response to that.

The Government Accounting Office—that shows how old I am—the GAO has been auditing Webb and they are mandated by Congress I think once or twice a year to report on Webb. And so to avoid duplication our office hasn't.

But from my perspective inside the building it goes to what I talked about in the opening statement just about NASA's historic inability, particularly with large projects to handle these project management challenges.

We had, you know, cutting edge technology and this sort of culture of optimism. Now, you need a culture of optimism to go beyond the stars at NASA and that should be encouraged, but when you are talking about schedule and budget you can't—you shouldn't be that optimistic, and I think it was sort of the confluence of these factors and given the incredible, you know, enormity of the James Webb architecture that led to where they are. But unfortunately I think GAO is the one.

Mr. SCHIFF. Well, you know, I know, and thank you, we will certainly follow up with GAO, but I know in your assessment of systemic challenges facing NASA and what you describe as overly op-

timistic or over confidence you have to look at things like Webb to determine, you know, where you have the big problems.

Do you think in the case of Webb and others it was over optimism being able to develop technologies that were nonexistent at the time, was that really the driver or was that really only a small piece of it but rather problems in the acquisition process, in the development process, in the management and oversight process, were those much bigger contributors to the size of the overruns then the technological leaps that, you know, that we have to make on all of these new firsts?

Mr. MARTIN. I can't weigh those. My sense is that each of those played a role in where we find Webb to be. Both is way over schedule, way over cost.

I don't know whether it was the technological that was the primary driver or whether it was just the poor oversight, poor management, but it certainly came together and we are where we are.

Mr. SCHIFF. Thank you, Mr. Chairman.

Mr. WOLF. Dr. Harris.

Mr. HARRIS. Thank you very much, and I will give you a break from some of that to——

Mr. MARTIN. Kind of angle this way if you don't mind.

Mr. HARRIS. Oh, thank you.

NASA STRATEGY FOR IMPROVED INFRASTRUCTURE MANAGEMENT

You know, one evening I—I don't know why I was watching C-Span, but you know, I saw Burt Rutan from Composite Scale—Scale Composites rather, kind of talk about the future of space. And one of the most interesting but I think disappointing things he said was that these future missions, like they will be private missions and they will probably certainly not be launched or supported by anything the U.S. government owns or runs because there just too much red tape involved with it.

Your report here indicates that, you know, one of the problems facing NASA is this inability—it sounds like an inability to kind of make a decision whether to sell some of their excess properties or lease their properties.

The first question is, are there adequate measures in place in the agency to address the problems that Mr. Rutan suggested, which are that it is just too difficult to deal with the federal government? I assume he meant in leasing facilities or gaining access through leases to NASA facilities. So is there enough of an effort going on to deal with that?

And the second question is, you mention—there is actually a mention of an old report in 2007 and a slightly newer report about the number of properties, but do you have an estimate of what the estimated value of the excess properties would be either for sale or for lease?

Mr. MARTIN. We have done a recent review looking at NASA's leasing practices, and our bottom line was they could do better, in fact frankly could do much better.

I think as a fundamental matter as far as an inventory control they don't have a good database or good set of information about what facilities are even available for leasing. And then once they have identified a facility that is available to lease they don't mar-

ket it or they aren't transparent in their efforts. And so we made a series of recommendations there.

Fundamental to the leasing issue is you only get to the leasing question after you have decided that NASA needs to retain the facility for its potential future use.

If you have made the decision that it is excess property, that we no longer need it, then leasing should not be a way to avoid the fact that you need to give it a GSA and excess it and they may sell it to either another government agency or give it to another government agency or sell it to a private concern.

So I think one of the cautions that we raised in our report was not substitute leasing but perhaps the harder decision of saying we no longer need—we don't need it now and we have no future mission use.

Mr. HARRIS. And could you just let my office know where to get a hold of that report?

Mr. MARTIN. Sure.

Mr. HARRIS. That specific report. Thank you.

Mr. MARTIN. It is on the Web site. We will be happy to.

Mr. HARRIS. And have you made any estimate of the value—the potential value of either selling the property or leasing the property to the government?

Mr. MARTIN. As I spin around and turn and ask my head of audits.

Mr. HARRIS. I mean there was an estimate that ten percent—I think they said there was a 2007 report done that indicated that ten percent was excess, but I have to imagine that given that the Space Shuttle is offline it has got to be more than ten percent now.

Mr. MARTIN. That hasn't been updated. Our most recent report we identified 33 specific facilities, including vacuum chambers, test stands, airfields that NASA itself identified as having no current mission or no future mission use. And just the general upkeep for these 33 facilities was $43 million in one year alone.

So the upkeep for facilities that NASA has no current or identified future mission use is quite staggering.

Mr. HARRIS. But those are the facilities they have identified, but——

Mr. MARTIN. Correct.

Mr. HARRIS [continuing]. I would—I would guess that they are underestimating the number of facilities that they really perhaps don't need.

So when is the next plan to actually look property by property and to do an assessment of what is excess and what is not?

Mr. MARTIN. Well, I think my sense is that NASA is under requirement by Congress to come up with that. In fact every two or three years in the authorization bill NASA is required to assess. They never quite use the word BRAC, but they do talk about reducing unneeded infrastructure. And we have done a series of reports, we will continue to stay on them, and NASA has a series of initiatives under way.

Again, as I mentioned, they seemed quite promising if they have the will to see them through. These are very difficult at times political decisions.

Mr. HARRIS. Okay. Thank you very much.

Mr. MARTIN. Thank you.
Mr. HARRIS. Thank you, Mr. Chairman.
Mr. WOLF. Mr. Rooney.
Mr. ROONEY. Thank you, Mr. Chairman.
Mr. Martin, glad to see you still have a little bit of a Pittsburgh accent.

IMPROVING INFORMATION TECHNOLOGY SECURITY GOVERNANCE

Over the past couple years the House Intelligence Committee, which I sit on along with Mr. Schiff, has held countless hearings and briefings on the intelligence leaders regarding the growing threat of cyber espionage and its impact on our national security. As somebody who also sat on the Arms Services Committee last year and served in the military it is obviously a great concern for me.

And just yesterday the intelligence leaders announced that cyber warfare they believe is the single most—or biggest threat to our national security. And I share the chairman's concern over China's growing perpetration of these attacks.

These attacks, as you know, risk not only our intellectual edge but also the billions of dollars we have invested in competitive technology through programs in DoD and NASA.

What is most troubling is that NASA's technologies dual use by its very nature and many of the civilian use applications can be used for military and non-proliferation purposes.

So given our enormous investment and faith in the success of NASA's core missions this committee should do everything possible to help protect those investments from being compromised by cyber attack.

So my question to you is how, do you suggest that this committee can better enable NASA's CIO to compel mission directorates and contractors to share cyber threat information that is critical to developing technologies to prevent future attacks?

Mr. MARTIN. Right. We have long-standing concerns about the effectiveness of NASA's current IT governance structure to effectively handle the many serious IT security concerns.

We have an ongoing audit that we hope to wrap up in the next four or five weeks that is going to set out some significant findings and some significant recommendations for potential restructuring NASA's approach. Because as you may know NASA's CIO has very little authority over the mission directorates where frankly 60 plus percent of the funds, the IT funds, are spent. And so she can set out the—the CIO sets out policy but doesn't have the stick to ensure that that policy is effectively implemented.

So I think NASA needs to continue to do work to more effectively strike an appropriate balance there.

Mr. ROONEY. Thank you, Mr. Chairman.
Mr. WOLF. Thank you, Mr. Rooney.
Mr. Graves.
Mr. GRAVES. Thank you, Mr. Chairman. How are you doing inspector?
Mr. MARTIN. I am okay.
Mr. GRAVES. Good. You are doing well today.
Mr. MARTIN. Unless you tell me otherwise.

Mr. GRAVES. No, no, you are doing amazingly well.

NASA STRATEGY FOR IMPROVING INFRASTRUCTURE MANAGEMENT

And I wanted to follow up on Dr. Harris' thoughts there because that is intriguing to me that I read in your statement here there are 4,900 buildings and structures within NASA and you as well as your statements say your office has identified 33, or at least they have recommended 33.

Mr. MARTIN. Low hanging fruit.

Mr. GRAVES. Right. Out of 4900. What can we do?

And maybe first of all what is your office able to do? How far can you go to insure that they are being as transparent as possible about identifying those properties?

And then what can we do to further encourage not maintaining $43 million worth of maintenance expenses?

Mr. MARTIN. Right. We can keep the heat up through our audits and oversight, we can assess the Agency's efforts in identifying and divesting itself, or if they think they have a legitimate potential future mission moving to an option like leasing which would help at least fund the operation and maintenance cost, that NASA wouldn't be on—you know, that wouldn't be their expense.

But it really is going to be sort of a coming together of the Administration and the Congress about these are the future missions for NASA, the big ticket missions, these are the facilities that we need to accomplish those missions, and then once excess, you know, having frankly the institutional will, the political will to let those go, and that is what it is going to come down to.

Mr. GRAVES. Well, and you mentioned the political pressures earlier and then now political will.

When you have various properties, let us say it is these 33 that aren't being utilized whatsoever it sounds like and aren't being identified for future use but yet we are spending money to maintain them, what is the political gain of anyone of keeping them open? I don't understand the constituency that would say yes we want to keep a vacant building vacant.

Mr. MARTIN. You clearly don't have a NASA center in your district.

Mr. GRAVES. That is true. That is true. That is why I need your explanation.

Mr. MARTIN. Exactly. I have only been here for three and a half years at NASA, spent twelve years at Justice, Justice was a bit different on that.

I think there is a concern—I am told there is a concern that with capabilities if you have a test stand or a vacuum chamber you currently have and you make yourself a viable player for potential either current or future NASA projects, if you divest yourself of that ability you have less flexibility in arguing that you should be the recipient of that next project that is coming.

And there is a significant amount of downsizing of facilities or capabilities then the Center itself perhaps could be, do we still need that particular Center? And that sets up there is a lot of jobs there, there is a lot of economy. Those are the issues.

Mr. GRAVES. Okay.

Mr. MARTIN. It is a slippery slope.

Mr. GRAVES. Well, I am glad they aren't in the typewriter business or payphone business, because you know, things change. You know, I guess the economy changes technology changes, but to me—and you are right, I don't necessarily have a facility in my district, but I would much prefer an operating facility with employees that are being paid and receiving a paycheck in a facility that is not vacant as opposed to a vacant building or facility or airstrip or whatever it might be.

Mr. MARTIN. Right.

Mr. GRAVES. Well, I appreciate your explanation and transparency with that.

Mr. MARTIN. Appreciate that.

Mr. GRAVES. Thank you.

Mr. MARTIN. Thank you.

Mr. WOLF. Thank you.

Mr. Fattah.

COST SAVINGS FROM COMMERCIAL SPACEFLIGHT

Mr. FATTAH. You mentioned in your opening statement about the commercial crew successes both in terms of SpaceX and Orbital and a number of other of the contracts have come to fruition and good work is being done.

I want you to focus a little bit if you could tell us a little bit about the cost savings between the Administration's push to have missions to space station cargo delivered through a private company versus when we were doing it the old way with the shuttle.

Mr. MARTIN. Right.

Mr. FATTAH. Because I think this is one of the big cost savings as we go down the road in terms of lower orbit travel. So if you could comment on that.

Mr. MARTIN. Well, I can and I can't. We have not done a particular cost analysis to look at that, but obviously it became very, very expensive per shuttle flight. You know, we have heard numbers of upwards of $500 million per shuttle flight toward the tail end. We are sort of keeping the standing army marching forward, and so the shuttle was an inefficient vehicle for cargo. It was an essential vehicle for building the Space Station.

So we have not done. But the Space Act Agreements and then the follow on FAR-based contracts that NASA entered into, the $1.6 billion for SpaceX for the twelve resupply missions, two of which have been successfully accomplished and the $1.9 billion for Orbital for the nine resupply missions, you know, look to be relatively effective and economical.

Mr. FATTAH. Thank you, Mr. Chairman.

Mr. WOLF. Thank you, Mr. Fattah.

I have a number of other questions on the security issues, which we will come back to.

USE OF SPACE ACT AGREEMENTS

There is a wealth of information available through public online sources about unclassified Federal contracts, including who receives those contracts and what amount and for what purposes, but there appears to be no comparable source of information about NASA Space Act Agreements.

Is there any reason why Space Act Agreements should be treated differently than FAR-based contracts from an oversight or disclosure perspective?

Mr. MARTIN. None that I can think of, sir.

Mr. WOLF. NASA said that all Agreements concluded under international law are coordinated with other Federal agencies under a process managed by the State Department. What do you know about this review process? Do you believe it is an effective safeguard against Agreements that might pose a security risk?

Mr. MARTIN. Mr. Chairman, I know very little about the oversight process, which is one of the reasons why several weeks ago we opened a review looking at NASA's use of Space Act Agreements, the funded Space Act Agreements, the reimbursable, and the non-reimbursable Space Act Agreements. And NASA's structure and adherence to export control regulations will be a key focus of that review.

Mr. WOLF. Our office has reviewed a list of active NASA Space Act Agreements and found a number of North America subsidiaries of foreign companies on the domestic agreement list. Presumably these agreements were not subject to the additional State Department review because they were deemed domestic.

Should these agreements get additional scrutiny because of indirect ties to foreign entities?

Mr. MARTIN. Mr. Chairman, I believe that would be part of our ongoing review as well.

Mr. WOLF. Each NASA center is empowered to enter into its own Space Act Agreements with little or no Headquarters involvement. In fact we found that Headquarters did not even know the full universe of the agreements that had been entered into by the various centers.

Does this high degree of center autonomy cause inconsistency in the application of management standards or internal controls to Space Act Agreements?

Mr. MARTIN. Again, Mr. Chairman, I am sure that it does knowing how NASA works in its decentralized fashion, but this will also be a focus of our review.

Mr. WOLF. Okay. We will share it with you, but I saw a letter where there was a number of people who directly or indirectly had these agreements and they were advocating for somebody in NASA.

Would that be a problem if there were Space Act Agreements that were given and then some of the people who got those agreements were advocating for the person that gave the agreement?

Mr. MARTIN. Mr. Chairman, I would have to know more about the facts. I just don't know enough about that particular concern.

Mr. WOLF. Well, I am going to give you the letter and then you can get back to me by the end of the day just to tell me if you think there is a potential problem.

Mr. MARTIN. Yes, sir.

NASA STRATEGY FOR IMPROVING INFRASTRUCTURE MANAGEMENT

Mr. WOLF. There are many members of Congress who oppose a proposal to eliminate some specific pieces of NASA infrastructure and point to the possibility of leasing that infrastructure to an ex-

ternal user as a preferable alternative, but you believe that leasing is often not an acceptable or beneficial option. Why is that?

What do you think of NASA's recent announcement that it would seek to lease Hanger One at Ames, one of the facilities that your office has determined has no current or future NASA purpose?

Mr. MARTIN. My understanding of the current state of the Hanger One is it has been excessed to the General Service Administration and the General Service Administration is in the process of finding a new tenant for the facility. Once it is excessed to the General Service Administration it is out from the NASA umbrella and outside of NASA's recurring cost of operations and maintenance.

So I have no problem—the Inspector General's Office has no problem with finding a tenant for Hanger One, our audit when we did the review of Hanger One, NASA had no current or future mission use, and our recommendation if you have no current or future mission use for any facility, particularly one as big as that, is get rid of it, and that is what NASA did.

Mr. WOLF. Well, I am going to give you another letter from a group, and I won't mention their name, with regard to that. Could you get back to me by the end of the day and tell me if you think there is a problem? Okay?

Mr. MARTIN. Yes, sir.

Mr. WOLF. Okay.

COST AND SCHEDULE PERFORMANCE

NASA's difficulties with cost and schedule performance are serious and long-standing. According to GAO, however, there is evidence of significant improvement over the past few years among major projects other than the James Webb and the Mars Science Lab. Do you agree with this characterization?

Mr. MARTIN. I agree that there has been some improvement, in fact we put out an audit in the last 30 days that looked at the Maven Project, which is the Mars atmospheric rover that they are going to hopefully launch in November of 2013, and it is a relatively small in NASA terms, it is a $453 million project that appears to be on cost, schedule, and timetable for launch.

So I think NASA still has difficulty with its larger projects, and so we will see whether some of the new techniques and protocols they have will be as applicable to some of the larger projects like Webb.

Mr. WOLF. So do you think there are factors that they have dramatically improved, or you don't know?

Mr. MARTIN. I think they have improved, I wouldn't call it dramatically improved.

Mr. WOLF. Last year NASA proposed the cancellation of GEMS Mission due to concerns about cost and schedule risks. This was a relatively rare proposal, at least in terms of science projects.

Do you think the cancellation of GEMS is a sign that cost and schedule discipline are now being more seriously enforced within the agency, or was the GEMS cancellation an isolated incident?

Mr. MARTIN. I think that remains to be seen. I hope it is an indication of more adherence to the cost and schedule fidelity, but I think it remains to be seen whether it is just an aberration.

Mr. WOLF. Our experience with the GEMS cancellation proposal showed that while NASA has reams of policies and procedures for approving missions, it has surprisingly little formal guidance for how to go about canceling programs.

Have you come across this issue in your assessment of NASA's project management practices? Don't you agree that clear cancellation criteria and procedures are necessary for effective and appropriate cost discipline?

Should there be a procedure that kind of fits—not that everything fits into it—but we check one, check two, check three?

Mr. MARTIN. I agree that there should be a standardized procedure to cancel a project. I think it has happened so rarely that that is probably why one doesn't exist. I agree that one should exist.

Mr. WOLF. How many—and you can submit it for the record—but how many have been canceled in the last ten years?

Mr. MARTIN. I think very few, and I would like to submit that for the record to get you an exact number.

[The information follows:]

According to NASA's Chief Engineer, since 2003 NASA has cancelled 10 Science Mission projects and the Ares I rocket program.

Mr. WOLF. Okay.

CONFERENCE EXPENDITURES

Your office has a mandate to review NASA's annual expenditures for agency-sponsored conferences. Have you seen any evidence of inappropriate or excessive expenditures such as those that emerged at the GSA and several other Federal agencies last year?

Mr. MARTIN. We have not.

Mr. WOLF. While NASA sponsors a number of its own conferences each year, the agency is also an active participant in many external conferences, including some that take place overseas and are quite expensive to attend.

Does your office conduct any oversight of NASA's expenditures associated with attendance at non-NASA conferences? If so, do you believe their process for balancing the cost and benefits of attending these events is transparent and well reasoned?

Mr. MARTIN. We do review NASA attendance at all international conferences, and I do believe the process is transparent.

Mr. WOLF. Okay.

RIF BANS

NASA is statutorily prohibited from conducting reductions in force among its civil service employees. Are you aware of any other agencies in government with this kind of restriction?

Mr. MARTIN. With the exception of possibly the DoD, no, I am not familiar. I don't know.

Mr. WOLF. Okay.

Mr. Fattah.

Mr. FATTAH. Thank you.

MAINTAINING LEADERSHIP IN SPACE

Earlier before I came to the hearing I met with a young man from Boston University who is doing some post doctorate work and

was over in CERN in Switzerland working with the Super Collider there.

We used to have the world's largest Super Collider and we ceded that, you know, to your European friends, and so we have—when our smartest young people, you know, who spent some years over there doing some work and now he is back.

This is the danger in this exercise at times. We have to be careful that we now have the premier space exploration agency in the world, and you know, we have to have appropriate oversight, but we don't want to be penny wise and a pound foolish as we go forward. You know, if we want to have global leadership in terms of space we are going to have to make that investment.

And so when President Kennedy in 1962 charted this course for the nation and over these many years, you know, we have been able to continue these investments, I want to thank the chairman in particular, the James Webb Telescope was one of the items you mentioned at the front end of your comments, and when we start talking about cost overruns this is one of the items that comes up.

There is no possibility that we should not proceed with this project however. And this is—part of the reason why NASA has these challenges is not because people are purposely underestimating what the cost is, this actually is rocket science. I mean it is hard to do, some of the work that is being done. And the more you get at the cutting edge of it the more difficulty comes with it.

So this is not just a matter of, you know, accountants figuring out what the cost of something is. The figuring out the cost of doing something you have never done before is challenging.

And so the big science projects of our nation whether it is the Webb Telescope or whether it is a manned mission to Mars, these are important mile markers associated with whether or not America intends to be number one in the world or whether we plan on ceding that to someone else.

And so I just—I mean I am very interested that we have better project management, but I don't think that we can substitute global leadership for, you know, better accounting, you know, that it is going to cost money and the chairman I think worked, you know, some magic to find additional resources in the last time that we moved the bill, which is a little bit back a ways, but to keep the Webb moving forward.

Just so it is like the Super Collider, you know, one of these big science deals, right, and the Super Collider we ceded on and that is unfortunate, we aren't going do that with the Webb, and we can't ever expect that when we deal with, you know, these kinds of issues that we are going to be able to isolate, you know, the cost of every paper clip, because in some cases we aren't talking about paper clips, and we are talking about things that we can't really put a price on and it takes a level of investment and daring and boldness on behalf of our nation and continue to lead.

So I thank the chairman and I thank you for your work.

Mr. MARTIN. Thank you, sir.

Mr. WOLF. Well, again, I agree with Mr. Fattah. I think that is one of the reasons why we are going have to hopefully come up with a grand bargain that reforms the entitlements and does some of those things, so we don't just squeeze the domestic discretionary

down to where we just can't function and can't be the leader that we want America to be. So I completely agree.

Mr. Aderholt.

Mr. ADERHOLT. Thank you. I apologize for being late, I was chairing another subcommittee, but glad to be here. Thank you for being here this morning.

I do want to express my strong support for the Chairman's inquiries regarding the security violations regarding the foreign nationals at Ames and Langley.

I want to echo the point that we must have a timely investigation by your office when such violations occur, since even a small breach of security can lead to a dangerous erosion of our national security.

So I support Chairman Wolf on these matters and look forward to prompt answers to the questions that have been submitted to you.

BUDGETING FOR THE SPACE LAUNCH SYSTEM

The Office of Management and Budget has imposed on NASA a flat line budget of $1.1 billion a year for SLS, a rocket which far exceeds the capacity even of the largest ULA rockets.

I know of no engineers who would say that a multi-year rocket development budget exists as a flatline budget. There are peaks and there are valleys. The authorization bill acknowledges this.

What is your opinion of the financial impact to NASA of imposing a budget not recommended by engineers? Does it risk wasting dollars by prolonging a program's development time or by provoking a termination of the program?

Mr. MARTIN. This is a complicated issue. We don't have an ongoing audit looking at the SLS development, but we do have an ongoing audit looking at the multi-purpose crew vehicle, which of course is one of the components of the heavy lift rocket, and I think there are some concerns along the same lines there about a flatline budget that is going out 10 years that is that a financial trajectory that is possible for success, and I think there are some significant questions there.

So we haven't audited the SLS development yet, we plan to do that probably in the next 6 months, we will open an audit on that, but there are some very serious concerns, whether there is adequate funding for these programs in the long term.

Mr. ADERHOLT. Did your office play any support role of any kind in the termination of the Constellation Program?

Mr. MARTIN. We don't. The Office of Inspector General has no role in the programmatic element of the agency.

Mr. ADERHOLT. Okay.

If the government allowed a business to take a GAO building and use its own funds to make the building usable that would be a lot cheaper than for that company to have to build its own building from scratch. I think it would be fair to call the arrangement a significant subsidy for that company's business costs.

Looking at the value of NASA and of Air Force facilities and ranges what is the value of what SpaceX has received from the U.S. government?

Mr. MARTIN. I have to get back to you with the exact figure. I know that they have received in the upwards of 300 and I want to say 400 or so million dollars in the Space Act Agreement for commercial cargo, and then they entered into a FAR-based contract I believe of $1.6 billion for twelve cargo resupply missions.

Orbital received I think 200 million or so in the Space Act Agreement and then entered into a FAR-based contract for $1.9 billion for its nine cargo missions to the ISS.

[The information follows:]

As of the end of fiscal year 2012, NASA had paid SpaceX $992.6 million for cargo and crew development and services.

Mr. ADERHOLT. Okay.

We have received rocket launch sale figures and promises from commercial companies who also are heavily critical of funds given to ULA to maintain ULA's availability to the U.S. government to launch classified satellites.

We can't know the true cost of a commercial launch unless we figure in the significant benefits the U.S. government provides.

How much money has been spent under the umbrella of SLS funding and what is the value of that spending for commercial companies who will also be allowed to use these facilities?

Mr. MARTIN. Yes, sir. I don't know the answer to that question, I would have to get back to you if I could.

Mr. ADERHOLT. Okay. If you could get back with us on that I would appreciate it.

Mr. MARTIN. I would.

[The information follows:]

NASA has spent $1.7 billion on the Space Launch System (SLS) since its inception through February 2013. This amount does not include costs associated with the Orion MPVC program or ground systems development.

Commercial cargo and crew have a separate line of funding and do not receive funding from the SLS program. SLS systems and facilities are not being built with an objective for compatibility with commercial launch systems. Rather, commercial companies that choose to use NASA facilities normally do so under cost reimbursable agreements.

Mr. ADERHOLT. Thank you, Mr. Chairman.

Mr. MARTIN. Thank you, sir.

Mr. WOLF. Thank you.

SECURITY ALLEGATIONS AT THE AMES RESEARCH CENTER

Has your office done any assessment of NASA's procedures for vetting and clearing contractors or academic partners for access to NASA facilities or data? And if so, what have your findings been?

Mr. MARTIN. I don't believe we have done any work on that certainly since I have been here.

Mr. WOLF. Is it time to look at that maybe?

Mr. MARTIN. It sounds like it is.

Mr. WOLF. Particularly with Ames. I would appreciate that. Thank you.

Mr. MARTIN. Yes, sir.

Mr. WOLF. Would you agree that a background investigation that doesn't identify individuals with ties to organizations or governments considered to be security or counterintelligence threats is not a very good background investigation?

Mr. MARTIN. I would agree with that.

Mr. WOLF. Background investigations may be an area in which new and improved policy is needed, but NASA also has problems when a perfectly adequate security policy is in place but the policy is not enforced, and you referenced that earlier.

For example, sensitive information is not to be shared before undergoing an export control review, and yet we have seen examples where that straightforward directive hasn't been followed.

Is the problem that most of NASA's employees are unaware of existing security policies?

Mr. MARTIN. I don't know that, sir, that is the—you know, what I said earlier was that I think the appropriate policies are there both from a security perspective and from an export control perspective. Whether they are understood by the NASA populous more broadly or the folks that are in the office of security or export control or the program managers, the sponsors of these individuals, whether they are adhered to that is the $100,000 question.

INFORMATION TECHNOLOGY SECURITY THREATS

Mr. WOLF. When you last appeared before the subcommittee you testified that NASA was one of the top four federal agencies, and you referenced it earlier, that are targets of cyber attacks, and that many of those attacks originate in China and eastern Europe. Is that characterization of the threats still accurate today?

Mr. MARTIN. Absolutely.

Mr. WOLF. What percentage of the cyber attacks do you think are from China and what percentage are from eastern Europe?

Mr. MARTIN. I don't have a percentage. We have worked a number of cases particularly serious intrusions out of the Jet Propulsion Laboratory that were traced back to Chinese-based IP addresses. We have also had a very successful case in Estonia where we arrested six Estonians and indicted one Russian on various cyber charges.

Mr. WOLF. So of all the cyber attacks against NASA since you have been there, where are most of them from?

Mr. MARTIN. I think you have touched base—well, I would say China, I would say eastern Europe, I would say Africa.

Mr. WOLF. Can you give roughly—we aren't going to hold you to this—but roughly give us a percentage?

Mr. MARTIN. I could spin around and ask my head of investigations. About 40 percent from China.

Mr. WOLF. Forty percent.

Mr. MARTIN. For the cases that we are working, yes.

Mr. WOLF. And then the next government, the next area?

Mr. MARTIN. Probably 30 eastern Europe and then Africa.

Mr. WOLF. Okay. Where in Africa?

Mr. MARTIN. Nigeria.

Mr. WOLF. All right, Nigeria.

Mr. MARTIN. And we have worked cases in each of these countries where we send Office of Inspector General agents to those countries working with local authorities to apprehend.

Mr. WOLF. Okay.

This is an easy question, but I assume you agree with what Directors Clapper and Brennan and Mueller said yesterday with regard to cyber being the number one threat?

Mr. MARTIN. Absolutely. We have been singing that song for years ourselves.

Mr. WOLF. Okay. Well, I am going to have a number of other questions. I am going to go to Mr. Fattah and see if he has anything else. But let me just say——

Mr. FATTAH. I am prepared to reserve, so I don't have anymore at this point.

Mr. WOLF. Okay. We are going to give you two things to take to look at, if you could, and give us a call by the end of the day.

Secondly, I really do think there is a potential problem in your office. We are going to give you an opportunity to address it, but we are going to stay with it.

Mr. MARTIN. Absolutely. And I look forward to discussing it with you and your staff, sir.

Mr. WOLF. And if need be, we are going to seek a change if we think it is appropriate.

I don't sense that there is that intensity with regard to this issue that I think is appropriate. And I want to just kind of give you background for understanding it.

The Chinese people are wonderful people. When most of the Chinese dissidents come to our country, they come to my office. Chen, the blind activist was by my office last week. So I think of all the members of this body, I probably speak out more for the Chinese people than most.

But the People's Liberation Army is the same group that opened fire and killed the people in Tiananmen. The People's Liberation Army are the same people that are doing the cyber attacks.

Mr. MARTIN. Yes, sir.

Mr. WOLF. The People's Liberation Army are the people who now go into prisons and, for $50,000 to $60,000, will get a person not voluntarily to donate a kidney by killing him. They are selling kidneys.

The People's Liberation Army are involved in aiding the Sudan government, which is bringing about genocide.

I was up on the Nuba mountains this time last year. All the efforts, all the weapons, all the supplies are coming from the Chinese government and the People's Liberation Army. Who, I will ask you, runs the Chinese space program?

Mr. MARTIN. I am sorry, sir?

Mr. WOLF. Who runs the Chinese space program?

Mr. MARTIN. I am assuming the Chinese military runs the Chinese space program.

Mr. WOLF. Is that assuming or did you know it is? I would hope you would have known. The People's Liberation Army runs—that is what you are saying, right? Runs the program?

Mr. MARTIN. That is my understanding.

Mr. WOLF. Okay. So we are very serious about this and we expect your people to be. You may send a message to your people at the local level, because if I don't think we are making progress we

will do a data dump and let all this information come out so that the world can see what is taking place.

Now, I think it is appropriate that we give you an opportunity, but some of the comments I have heard are that at some of the local centers your people have not been as enthusiastic about this as I think is appropriate. I believe this deals with the national security of our country, it deals with jobs, and it deals with having an opportunity for Americans to have jobs that aren't taken away by others. And lastly, it deals with the safety and the security of the men and women that are serving in the military. We have an obligation to them.

Mr. MARTIN. Mr. Chairman, if I could, I couldn't agree more with that. I look forward to the discussion with you and your staff, but I respectfully disagree that the Office of Inspector General is shirking its duties. We are an aggressive independent entity out there securing NASA, its information, its facilities, and we look forward to working with you and your staff.

Mr. WOLF. Well, let the record show that we disagree strongly, and I think that there are times that the IG has failed. If we don't see results, we will lay out where the IG has failed and we will call it the way that it is. So I want you to know that.

Mr. MARTIN. We look forward to those discussions.

Mr. WOLF. Okay. And even, if need be, we will say that the office ought to be changed.

With that, Mr. Fattah, I will ask you if you have any last comment?

Mr. FATTAH. I have no further comment.

Mr. WOLF. Okay. With that the hearing is adjourned.

QUESTIONS FOR THE RECORD—MR. WOLF

SECURITY

Question. You testified that there are multiple entities at NASA who play a role in the detection and investigation of agency security violations, and that each entity works within its specific "lane". Can you describe those entities (including the OIG) and how their jurisdictional lanes differ from one another?

Answer. In addition to the Office of the Inspector General (OIG), NASA's Office of Security and Program Protection (OSPP), Office of International and Interagency Relations (OIIR), and Office of the Chief Information Officer (OCIO) all play a role in detecting and/or investigating security-related issues at NASA.

The OIG. The OIG is responsible for investigating violations of Federal criminal and civil statutes relating to NASA programs and operations, for coordinating such matters with the U.S. Department of Justice, and for referring violations of state and local laws to the appropriate authorities. In addition, the OIG investigates allegations of serious non-criminal misconduct by NASA employees or NASA contractors. Examples of security-related issues the OIG investigates include cyber-attacks on NASA information technology (IT) systems, child pornography on NASA networks, violations of export control laws and regulations, destruction and theft of NASA property, counterfeit parts and product substitution involving aeronautics and space hardware, illegal possession of weapons on NASA Centers, and improper access to NASA IT systems or information. The OIG is not responsible for intelligence or counter-intelligence functions at NASA and does not investigate allegations of espionage.

OSPP. OSPP provides security and protection for NASA personnel, missions, facilities, property, and information. This includes both physical security including badging and visitor access at NASA facilities, as well as responsibility for intelligence and counter-intelligence matters. OSPP coordinates directly with the Federal Bureau of Investigation (FBI) regarding intelligence and counter-intelligence matters, and the FBI takes the lead in investigating allegations of espionage.

OIIR. OIIR's Export Control and Interagency Liaison Division manages NASA's Export Control Program and is responsible for ensuring Agency compliance with related law and regulations, providing policy guidance, and representing the Agency on interagency working groups dealing with international technology transfer, non-proliferation, and export control. OIIR does not have investigative authority.

OCIO. OCIO is responsible for IT security across NASA through the development and maintenance of an information security program that formulates IT security policies, identifies and implements risk-based security controls, and tracks security metrics. Like OIIR, the OCIO does not have investigative authority.

Question. Do you believe that these jurisdictional lanes are clearly drawn and fully understood by all relevant parties? If not, how could they be improved?

Answer. Yes, we believe these jurisdictional "lanes" are clear. The OIG and the OSPP entered into a Memorandum of Understanding in 2011 that clearly delineates the respective roles of each organization and sets forth the procedures for reporting information and allegations between the two organizations. In addition, the OIG communicates frequently with the OCIO and OIIR on matters of mutual interest. Of course, even clearly drawn and widely understood jurisdictional "lanes" require professionalism, diligence, and constant communication among those entities with a role in protecting information and physical security at NASA.

Question. In instances where the jurisdictional lanes overlap, how is it decided which entity will take the lead on any given case? Please include specific decision-making criteria to the maximum extent possible.

Answer. As noted above, the OIG is the entity charged with investigating criminal matters at NASA and may also investigate allegations of serious, non-criminal misconduct by NASA employees and contractors. Accordingly, the MOU between the OIG and OSPP requires OSPP to immediately report to the OIG allegations or incidents involving any NASA program, operation, employee, or contractor which, if substantiated, would constitute a prosecutable offense, except allegations or incidents involving counterintelligence and counterterrorism. The OIG reviews all allegations it receives from OSPP (and other sources) to determine whether they appear to involve criminal or serious non-criminal conduct. Matters that do not meet this threshold are generally referred to NASA management.

Question. How many criminal investigations has the OIG conducted over the past five years involving export control violations and/or unauthorized access by foreign nationals? How many of those investigations resulted in prosecutions or plea deals?

Answer. Over the past 5 years, the OIG has conducted 42 investigations involving alleged export control violations and/or unauthorized access by foreign nationals. Sixteen of these investigations are active matters. One investigation resulted in an indictment and conviction. Another resulted in

an indictment, but the defendant was acquitted at trial. Several other OIG investigations led to recovery of ITAR-controlled property, removal of contract employees, and improved controls and targeted training with regard to the proper handling of sensitive unclassified information.

Question. In security-related cases where criminal charges are not pursued, what other types of investigations and remedies are potentially available to the OIG?

Answer. In cases where the U.S. Attorney declines to pursue a matter criminally, the OIG may review the matter administratively and provide a report of its findings to the Agency. The Agency may take various actions based on such reports, including disciplinary action against an employee, suspension or debarment of a contractor or grantee, or improvements to Agency processes and procedures.

Question. How does the OIG publicize the services of its whistleblower ombudsman? Do you believe that most NASA employees are aware of the existence of this office?

Answer. The OIG Whistleblower Protection Ombudsman function was established in December 2012. We have posted information prominently on our website homepage about the function and have published several notices in NASA's weekly e-publication sent to all Agency employees. In addition, in April the Inspector General will send an e-mail to all 18,000 NASA employees describing the Whistleblower Protection Ombudsman resource and providing contact information. Information on the Whistleblower Protection Ombudsman function has also been incorporated into NASA-required on-line Fraud Awareness training and we are planning to incorporate similar information into NASA's statutorily mandated No Fear Act training.

INFORMATION TECHNOLOGY (IT) SECURITY

Question. You testified that the information technology security threat facing NASA has not abated over the past two years, but has NASA's preparedness to prevent and respond to those attacks improved during that time period?

Answer. The Agency has improved its ability to detect and respond to advanced cyber-attacks over the past several years. For example, in an effort to prevent the loss of sensitive data resulting from "phishing" attacks, the Agency regularly monitors employee e-mail for potential malicious content. In 2011, this initiative prevented 28 of 47 (67 percent) of a particularly malicious type of cyber-attack known as an Advanced Persistent Threat . Moreover, the Agency is expanding the capability of its Security Operations Center—NASA's

central coordination point for the detection of, response to, and reporting of information technology security incidents—to include continuous monitoring of its mission and high-performance computer networks. However, as noted in recent OIG testimony to Congress, the Agency has yet to implement recommendations from a 2010 audit to establish an oversight program for its mission networks to ensure they are monitored for the presence of critical software patches and technical vulnerabilities.

Question. NASA generally scores well on Federal Information Security Management Act (FISMA) assessments, despite the fact that we hear regularly about NASA's vulnerability to significant IT security threats. Are NASA's FISMA scores an accurate reflection of their overall security posture?

Answer. No. FISMA scores reflect how well a Federal agency documents compliance with the ten FISMA reporting areas. Although our annual FISMA reviews usually find that NASA's security documentation generally complies with FISMA reporting requirements, this does not mean that Agency computer networks and systems are adequately protected from cyber threats. Over the past three years, NASA IT security initiatives have focused on using tools and techniques to conduct ongoing monitoring of key IT security controls. Specifically, the goal of this continuous monitoring initiative is to determine whether a system's key IT security controls continue to be effective over time in light of system changes. A well-designed and well-managed continuous monitoring program can transform an otherwise static security control assessment and risk determination process into a dynamic process that provides essential information about a system's security status on a real-time basis. NASA's continuous monitoring initiative is still immature but over time has the potential to significantly improve NASA IT security posture.

Question. Does JPL's status as a Federally Financed Research and Development Center (FFRDC) complicate NASA's attempts to protect the agency information and systems that are used by JPL? If so, can NASA learn any lessons from other agencies with significant FFRDCs, such as the Department of Energy?

Answer. NASA's contract with JPL dictates the IT security measures JPL must implement. Over the past several years, JPL has experienced a number of significant IT security incidents that have resulted in unauthorized access to key JPL systems and the loss of sensitive program and ITAR data. Our investigations of these incidents show a recurring theme of poor security practices such as failure to apply software patches in a timely manner, failure to limit access to accounts having elevated privileges such as administrator accounts , and an ineffective defensive infrastructure for cyber-attacks. We

have brought these matters to the attention of NASA and JPL's management and their respective IT Security teams. As a result, JPL's management has recently instituted a comprehensive action plan to improve IT security infrastructure and practices. We are monitoring JPL's implementation of this plan.

Question. What specific changes are needed in NASA's IT governance model in order to improve the agency's IT security posture?

Answer. The decentralized nature of NASA's operations and its longstanding culture of autonomy hinder the Agency's ability to implement effective IT governance. We are currently examining whether NASA's existing IT governance structure appropriately aligns authority and responsibility in support of overall mission of the Agency. Specifically, we are reviewing whether NASA's OCIO has the organizational, budgetary, and regulatory authority to effectively meet the Agency's varied missions. We expect to issue a final report in May 2013 that will contain specific recommendations with regard to NASA's IT governance structure.

Question. Why do you believe NASA has not made changes in its governance model yet? What are the potential disadvantages to concentrating more central authority in the Office of the CIO?

Answer. As previously mentioned, the decentralized nature of NASA's operations and its longstanding culture of autonomy hinder the Agency's ability to implement effective IT governance. Further, NASA's IT environment is widely distributed, with hundreds of networks and devices owned and operated by the Mission Directorates and Centers, and no single office or organization is responsible for funding and securing related assets. As noted above, we will be making specific recommendations for improvement in our upcoming IT Governance report.

Question. After last year's theft of an unencrypted laptop, NASA undertook an urgent, comprehensive laptop encryption effort. While that effort is complete, a substantial number of laptops were given waivers from the encryption requirement. What standard did NASA use to allocate encryption waivers? Did your office review NASA's process for considering and providing waivers?

Answer. We have not reviewed NASA's process for granting waivers to the DAR encryption requirement. According to NASA, laptops that are waived from the data-at-rest (DAR) encryption requirement must remain on NASA property. Examples include laptops related to life safety systems and multi-user systems that do not store sensitive data such as export-restricted, international traffic in arms regulation, or personally identifiable informa-

tion. A majority of the laptops that received waivers from the encryption requirement are located at the Johnson Space Center, and according to Center officials mirror computer systems on the International Space Station. In March 2013, NASA issued a Program Decision Memorandum (PDM 2013–127-EUS) defining the roles and responsibilities of individuals who are involved in the waiver process and providing guidance for this process. Waivers are valid for one year and must be renewed annually.

Question. What is the status of NASA's efforts to protect its other mobile IT devices, such as tablet computers or smart phones?

Answer. We have an ongoing review evaluating NASA's oversight of these devices.

COST AND SCHEDULE PERFORMANCE

Question. To what do you attribute NASA's recent improvements in cost and schedule performance?

Answer. We recently reported that NASA's Mars Atmosphere and Volatile Evolution (MAVEN) project was achieving success by addressing challenges that have historically hindered other NASA projects. We found that MAVEN managers have been able to overcome these challenges by forming a strong and experienced leadership team; emphasizing the use of heritage technologies that did not require significant modifications; receiving a stable funding profile; and effectively using sound project management methodologies, tools, and contracting initiatives. It remains to be seen whether NASA will be able to achieve similar success on its larger projects.

For example, in March 2012 the Government Accountability Office (GAO) reported that the James Webb Space Telescope experienced development cost growth of $3.6 billion (140 percent) and a schedule delay of more than 4 years. GAO noted that this growth in cost and schedule had a residual impact on 14 other large-scale NASA projects, resulting in an average development cost growth of $79 million (14.6 percent) and schedule growth of 8 months from project baselines.

Question. Your report on the drivers of cost and schedule growth in NASA projects did not contain any specific management recommendations. Why not, and when do you anticipate that such recommendations will be made?

Answer. The objective of the report was to examine NASA's project management practices to better understand the Agency's challenges for achieving its cost, schedule, and performance goals. The findings presented were primarily based on our analysis of the input received from interviews with 85

NASA project managers and other officials, along with additional information from previous studies conducted by NASA, our office, the GAO, and other organizations.

In summary, we identified challenges related to (1) NASA's culture of optimism, (2) the inherent technical complexity of projects, (3) funding instability, and (4) limited development opportunity for project managers. For example, we suggested that a unity of effort and focus is required to address these overarching challenges; that funding should be adequate, properly phased, and managed as part of formal risk mitigation strategies; and NASA leadership should hold managers appropriately accountable for mismanagement of resources. As noted, we made no formal recommendations in the report, instead offering our analysis of each of the four challenge areas and, in some cases, noting actions the Agency may wish to consider to help improve project management. We plan to conduct audit work in each of these areas that will offer more specific recommendations for management action.

Question. Do you believe that large and small projects are held to the same standards with respect to cost and schedule performance? If not, do you think this disparity is appropriate or useful?

Answer. NASA's project management requirements dictate that large and small projects be held to the same standards. As we pointed out in our project management report, many factors can influence cost and schedule performance. Underestimating the technical complexities associated with building one-of-a-kind, first-of-their-kind space systems can lead to unreliable cost estimates and unattainable schedules. Moreover, some of NASA's smaller projects utilize heritage technologies—instruments built and used on previous missions – which tends to lower programmatic risk. NASA also cost caps some of its smaller missions. For example, Discovery missions are planetary mission with total costs not to exceed $425 million, excluding launch vehicle costs. In comparison, larger projects such as the James Webb Space Telescope and the Mars Science Laboratory are not cost capped and may be viewed as "too big to fail" when problems occur. Moreover, the impact of even modest cost growth in a large mission can be substantial.

Questions for the Record—Mr. Aderholt

Question. The Commercial Resupply Service (CRS) contracts each call for 20 metric tons to be delivered to the International Space Station. The Orbital contract is for 8 flights, at approximately 1.9 billion dollars. The Space X contract from NASA is 12 flights, at a cost of approximately 1.6 billion dollars ($1.243 billion dollars of CRS contract funds have been paid to the companies

(total), as of the end of February 2013). The second CRS flight by Space X is currently in operation, and is taking up 1,268 pounds. Their first flight took up 882 pounds—for a total of 2,150 pounds—and 12 flights averages out to about 3,675 pounds per flight. Meanwhile, we are awaiting Orbital's first flight.

Has your office opened an official audit on the CRS program, with the determining whether it is possible to achieve the contracted promise of 20 metric tons to orbit? How will your office hold NASA accountable regarding the fact that almost one billion dollars in CRS funds were paid (collectively to the two companies) before the first CRS flight took off?

Answer. We are currently examining the extent to which NASA and its commercial partners—SpaceX and Orbital—are on track to provide a system capable of resupplying the International Space Station, including the contracting approach, funding, and mission status. This review will specifically address the expenditure of CRS funds in advance of actual services. We expect to issue this report in May 2013.

Question. Can I receive a copy of the flight manifest for Space X CRS flights 1–6, and the specific tasks which have been paid for by the current $554 million dollars provided to Space X, listed by cost for each task?

Answer. NASA's Office of Legislative Affairs has informed us that the Agency also received this question and will be responding to your request for this information.

Question. Also, I think that Space X will have a non US government flight between this current flight and CRS flight number 3. What has your office done to examine the timeliness for completing the 12 flights of this contact, and the 8 flights of the second contract?

Answer. This issue is being examined as part of our ongoing review.

Question. Space Policy Online raised some questions about the Space X CRS flight 1. Has your office launched an investigation into such matters as the following three?

- The effect of radiation on the Dragon capsule avionics?
- The g-load forces experienced during re-entry, and accuracy of the landing site?
- Whether any of the biological specimens were damaged or lost and why?

Answer. As part of our ongoing review, we expect to address issues related to radiation and impact to biological specimens. Information on g-load forces and the accuracy of the landing site are not within the scope of our review.

Question. What is your position on the Santa Susanna environmental cleanup and NASA liabilities? Should NASA include this in their budget request separate from funds used to develop the SLS rocket?

Answer. We recently issued a report on the "NASA's Environmental Remediation Efforts at the Santa Susana Field Laboratory" (report number IG-13-007, dated February 14, 2013). In that report, we found that NASA has agreed to clean its portion of the Santa Susana site to a level that exceeds the generally accepted standard necessary to protect human health in light of the expected future use of the site. Moreover, the cleanup is likely to cost the taxpayers significantly more than the cleanup effort NASA agreed to in its 2007 Consent Order with the State of California—a remediation level itself that was more stringent than what would be required based on the expected use of the site.

Although the precise outlines of the cleanup effort and therefore its ultimate cost have not been finalized, NASA estimates that cleaning the SSFL to background levels could cost more than $200 million, or more than twice the cost to clean it to residential levels and more than eight times the cost to clean it to a recreational use standard. In addition, because cleanup to background levels may require highly invasive soil removal, there is a risk that such a cleanup would result in significant damage to the surrounding environment and to archeological, historical, and natural resources at the site. We questioned whether NASA's agreement to clean its portion of the Santa Susana site to background levels is the best use of taxpayer funds. Given NASA's other environmental commitments and the fiscal constraints facing the Agency and the Nation, we concluded that NASA can ill afford to spend tens of millions of dollars to clean up an area above and beyond its risk level or expected use.

Environmental remediation projects such as the Santa Susana cleanup are funded through a separate appropriation line item, "Construction and Environmental Compliance and Restoration." The SLS is funded through NASA's "Explorations Systems Development" appropriation line item.

Question. We receive rocket launch sales figures and promises from commercial companies who also are heavily critical of funds given to ULA to maintain their availability to the US government to launch classified satellites. We cannot know the true cost of a commercial launch unless we figure in the significant benefits from US government funds. How much money has been spent under the umbrella of SLS funding in CECR funds, and what is the

value of that spending for commercial companies who will also be allowed to use these facilities?

Answer. We have not reviewed what funding, if any, is spent through Construction and Environmental Compliance and Restoration (CECR) funds for the purpose of supporting commercial companies.

TUESDAY, MARCH 19, 2013.

NATIONAL SCIENCE FOUNDATION

WITNESSES

HON. SUBRA SURESH, DIRECTOR, NATIONAL SCIENCE FOUNDATION
DR. BRAD J. BUSHMAN, PROFESSOR, OHIO STATE UNIVERSITY

OPENING STATEMENT OF CHAIRMAN WOLF

Mr. WOLF. Good morning. I want to welcome everyone to today's hearing on the National Science Foundation. Our first witness, Dr. Subra Suresh, is the director of the NSF.

This will be your last appearance before the subcommittee as director, but maybe you will be back in other capacities.

I would like to both thank you for your service to NSF and to wish you very good luck. I know you are going to do a great job in your new position at Carnegie Mellon. That is a wonderful institution.

I originally come from Pennsylvania. Actually, my roommate in college was, I think, the director of Admissions at Carnegie Mellon for a number of years. I think he was.

It is a great institution, and I would just say that they are lucky to get you. So I appreciate the great job you have done. I want to wish you well. I know we are going to continue to talk and stay in touch as time goes by.

Ordinarily we would spend this hearing discussing NSF's budget request for the upcoming fiscal year, but, unfortunately, the submission of the request has been significantly delayed—not because of Dr. Suresh, I want to make clear.

So we will be prevented from having a detailed conversation about your budget plans for 2014. However, there is still plenty of other material that is necessary and useful to address. We will discuss the status of projects you are funding with the current budget, management issues that affect your ability to effectively and efficiently carry out your operations, and changes in policies and procedures that could help make your agency an even better steward of Federal funds.

After we hear from Dr. Suresh on these issues, we will change gears a bit on our second panel, whose witness is Dr. Brad Bushman of Ohio State University. I want to welcome Dr. Bushman.

We appreciate your willingness to be here today.

Dr. Bushman recently served as co-chair of a subcommittee to NSF's Advisory Committee on Social, Behavioral and Economic Sciences and led that subcommittee in an examination of the causes of youth violence.

Dr. Bushman will give us an overview of the findings of the subcommittee, including a discussion of the major known risk factors

associated with youth violence and further research that is necessary to comprehensively address the problem.

It is my hope that this report will be helpful to all of us in policy-making roles as we attempt to develop an effective and appropriate response to last year's tragedy in Newtown.

In a moment, we will begin our first panel with some brief opening remarks from Dr. Suresh, who will then answer questions, and we will then turn to Dr. Bushman and proceed the same way.

But first I would like to recognize our ranking member, Mr. Fattah, for any opening remarks he would like to make.

OPENING STATEMENT OF RANKING MEMBER FATTAH

Mr. FATTAH. Well, let me join in with the chairman in thanking you for your service as the leader of the National Science Foundation. I think you have done extraordinarily important work on behalf of our Nation.

And the fact that you are going to lead one of the premier institutions not just in Pennsylvania but throughout the country indicates that you will be continuing to serve but in a different capacity.

Carnegie Mellon is an institution I have visited in my earlier life as a state senator in Pennsylvania. And I remember their early work in robotics.

But I wish you well. You have done a great service at the National Science Foundation with a number of initiatives from the innovation of corps to a host of other work that we will get into a little bit.

But I want to wish you well and I also want to thank you for your help in the neuroscience initiative and at the chairman's behest and you hosting the STEM education conference rollout in Philadelphia. So welcome again here to the committee and we look forward to your testimony.

Mr. WOLF. Thank you, Mr. Fattah.

Pursuant to the authority granted in Section 191 of Title 2 of the U.S. Code in clause 2(m)(1) of House Rule XI, today's witnesses will be sworn in before testifying.

Dr. Suresh, please rise and raise your right hand.

[Witness sworn.]

Mr. WOLF. Let the record reflect that the witness answered in the affirmative.

Dr. Suresh, your written statement will be made part of the record. You may proceed with your summary remarks and you may proceed as you see appropriate.

OPENING REMARKS OF DR. SURESH

Dr. SURESH. Chairman Wolf, Ranking Member Fattah, and Members of the subcommittee, it is my privilege to be here with you today. Mr. Wolf and Mr. Fattah, thank you very much for your kind words as well.

My testimony today will be the last time to address you and the subcommittee in my official capacity as the director of the National Science Foundation. I have gratefully appreciated the strong work-

ing relationship we have had over the past three years and this moment is bittersweet for me.

As I indicated in my memo to NSF staff last month, it is with mixed emotions that I face this transition from one exciting professional journey to another and from one remarkable institution fostering research and education to another.

I am saddened by the prospect of leaving the National Science Foundation, an organization that has become the dominant part of my life for the last three years. At the same time, I am excited about the new opportunities and challenges as I assume the leadership of an outstanding university.

With a strong partnership of this subcommittee and despite the economic crisis and the lingering uncertainties that have ensued, NSF funding has sustained growth through the turbulent times of the recent past.

The hard working and dedicated staff at NSF have created the gold standard for science funding for more than six decades. The programs and practices they have established have been emulated around the world and they have nurtured the creative balance of hundreds of thousands of scientists, engineers, students, and educators in every part of the U.S.

Their work has also supported the discoveries of some 200 American Nobel Prize winners who represent about 70 percent of all U.S. Nobelists since 1950.

I would add, Mr. Chairman, I don't think there is any other funding agency on the planet that can claim that. And as director of NSF, I am very proud to claim that.

Transitions such as the present one provide reasons to reflect on and to take stock of one's journey and to examine the key milestones encountered along the way.

My written testimony provides some examples that with the committee's strong support we have achieved in these last few years together. They are grouped into several major thematic areas: the one NSF philosophy and creation of new paradigms for cross disciplinary interactions and organizational efficiency, national priorities and grand challenges, support of major infrastructure projects, nurturing and expanding the innovation ecosystem, new models for global engagement, and principled commitment to human capital development and broadening participation.

These activities are not only being launched successfully, but they establish strong roots with support from a broad group of dedicated NSF staff. I, therefore, have confidence in the potential for continuing success and growth in the years to come.

I am extremely proud of the work that we have done together, Mr. Chairman, whether it was working with you and your staff in identifying highly successful K through 12 schools and programs in STEM education or being with Ranking Member Fattah for the rollout of those findings in Philadelphia, or the ability to use the foundation's convening powers to bring together experts on areas of national discourse like youth violence. I believe that together we have made an impact.

It has been my extraordinary honor to lead the National Science Foundation which is blessed with a marvelous cohort of highly talented, devoted staff as well as hundreds of thousands of innovative

grantees and investigators from every field of science and engineering.

I am grateful for the opportunity to serve the country in this capacity and to be the beneficiary of many wonderful life experiences as I witnessed and played a small role in helping to advance science over the past several years.

Mr. Chairman, I am most grateful for the working relationship with you and with Ranking Member Fattah and with your subcommittee.

I thank you for your leadership and especially for the warmth that you have shown me during my tenure at NSF. I look forward to answering any questions you may have.

[The information follows:]



Dr. Subra Suresh
Director
National Science Foundation

Before the
Committee on Appropriations
Subcommittee on Commerce, Justice, Science and Related Agencies
United States House of Representatives

March 19, 2013

Chairman Wolf, Ranking Member Fattah, and Members of the Subcommittee, it is my privilege to be here with you today. My testimony today will be the last time I am to address you and the Subcommittee in my official capacity as Director of the National Science Foundation. I have greatly appreciated the strong working relationship we have had over the past three years, and this moment is bittersweet for me.

As I indicated in my memo to NSF staff last month[1], it is with mixed emotions that I face this transition from one exciting professional journey to another, and from one remarkable institution fostering research and education to another. I am saddened by the prospect of leaving the National Science Foundation, an organization that has become the dominant part of my life for the past three years. At the same time, I am excited about the new opportunities and challenges as I assume the leadership of an outstanding university.

With the strong partnership of this Subcommittee, and despite the economic crisis and the lingering uncertainties that have ensued, NSF funding has sustained growth through the turbulent times of the recent past. The hard-working and dedicated staff at NSF have created the "gold standard" for science funding for more than six decades. The programs and practices they have established have been emulated around the world, and they have nurtured the creative talents of hundreds of thousands of scientists, engineers, students and educators in every part of the U.S. Their work has also supported the discoveries of some 200 American Nobel Prize winners who represent about 70% of all U.S. Nobelists since 1950.

Transitions such as the present one provide reasons to reflect on, and to take stock of, one's journey and to examine the key milestones encountered along the way. I would like to take this opportunity to share some of them with you, providing here excerpts from the letter to NSF staff last month. Although no list can be truly complete, I have reflected on a few accomplishments that, with the Committee's strong support, we have achieved in these last few years together. They are grouped in several major thematic areas: the OneNSF philosophy and creation of new

paradigms for cross-disciplinary interactions and organizational efficiency; addressing national priorities and grand challenges; support of major infrastructure projects; nurturing and expanding the innovation ecosystem; new models for global engagement; and principled commitment to human capital development and broadening participation. These activities have not only been launched successfully, but they have also established strong roots with support from a broad group of dedicated NSF staff. I therefore have confidence in their potential for continued success and growth in the years to come.

The OneNSF philosophy and the creation of new paradigms for cross-disciplinary interactions and organizational efficiency

- The intellectual and cultural flavors and associated activities in different offices and directorates of NSF are strongly influenced by the communities they serve in different fields of science and engineering. The OneNSF philosophy, introduced in 2011, seeks to facilitate greater coordination and collaboration among different entities within NSF and among different NSF-funded activities across the country and around the globe so as to extract the best value from investments. Many activities emerging from this approach also were designed to help mitigate barriers to successful interactions among different NSF communities.

- An example of the OneNSF approach to foster cross-disciplinary research involves the design of the new **Integrative NSF Support Promoting Interdisciplinary Research and Education (INSPIRE) Program,** by a working group of program officers representing different parts of NSF. These innovative colleagues worked hard to create novel mechanisms to support transformative, high-risk ideas that might otherwise not be selected for funding by traditional means. Their work has produced several new solicitations for innovative funding schemes for small projects in interdisciplinary research, mid-scale research projects and support of best scholars. In July 2012, INSPIRE established nearly 40 new interdisciplinary projects in its first funding cycle, with collaborative support and engagement from every office and directorate at NSF.

- The OneNSF approach has also enabled **greater integration of the educational and research activities** of NSF. We are forging much stronger ties between the Education and Human Resources Directorate and the educational activities embedded within research directorates by integrating cutting-edge research programs into educational activities to inspire young minds.

- In order to improve organizational efficiency and to foster a more streamlined and effective integration of offices supporting infrastructure and directorates supporting scientific research, a **realignment** and consolidation of different units was announced in September 2012. This led to the creation of the new Office of International and Integrative Activities, and the merger of the Office of Cyber Infrastructure with the Computer and Information Science and Engineering Directorate, and the merger of the Office of Polar Programs with the Geo Sciences Directorate. The realignment was completed at the beginning of 2013.

Addressing national priorities and global challenges

- The establishment, in partnership with our sister agencies in the federal government, of a variety of multi-agency initiatives intended to enhance the technological strength, global competitiveness and economic wellbeing of the nation. A partial list of the major programs launched during the past two years includes: the **National Robotics Initiative, the Big Data Initiative, the Materials Genome Project,** the **Secure and Trustworthy Computing Program**, and **the Advanced Manufacturing Initiative**.

- Creation of pan-NSF activities through the **Science, Engineering and Education for Sustainability (SEES)** program, and the **Cyber-Infrastructure Framework for the 21st Century (CIF-21)** program.

- Soon after the earthquake in Christchurch in New Zealand (which is a key launching pad for NSF activities in Antarctica) and the disaster involving the combined effects of earthquake, tsunami and nuclear reactor failure near Sendai in Japan in 2011, NSF quickly funded a number of **RAPID research projects** to facilitate time-sensitive and critical research interactions between U.S. scientists and their counterparts in New Zealand and Japan, respectively. These interactions have generated valuable research information on such topics as risk analysis, emergency preparedness, disaster mitigation, etc. NSF sponsored a workshop on "**Reckoning with the Risk of Catastrophe**" in October 2012 in partnership with the German National Science Foundation. These activities, in concert with existing NSF-funded networks such as the **Incorporated Research Institutions for Seismology (IRIS)** and the **George E. Brown, Jr. Network for Earthquake Engineering and Simulation (NEES)**, provide a national and international framework to generate much-needed scientific knowledge and infrastructure to respond to natural and human-made disasters.

- NSF serves as the Chair of the **Interagency Arctic Research Policy Committee (IARPC)**, a subcommittee of the National Science and Technology Council (NSTC). We have worked with the principals of other federal agencies and their working groups, to develop a five-year, national **strategic plan** for coordinated research in the Arctic region.

- NSF serves as the co-chair of the NSTC **Committee on STEM Education (Co-STEM)**, and have engaged the principals of a number of federal agencies and their staff to create the first detailed inventory of targeted STEM programs across the federal government. Various working groups of Co-STEM are also collaborating to develop a strategic plan. Efforts to harmonize the definitions and activities of a multitude of programs aimed at broadening participation across the federal government have also been initiated.

Support of Major Infrastructure Projects

- Despite the severe economic downturn, NSF has shown unwavering commitment to support the U.S. research community through a number of major infrastructure projects. New projects that have received significant funding during the past several years include: the **National Ecological Observatory Network (NEON)**, the **Ocean Observatory Initiative (OOI)**, the **Atacama Large Millimeter/sub-millimeter Array (ALMA) facility** in Chile (the official opening of which I participated in just last week), and the **Advanced Technology Solar Telescope (ATST)**.

- In order to support cutting-edge research in computational modeling and simulation, three new NSF-funded supercomputing facilities have been established within the past year. These include: the **NCAR-Wyoming Supercomputing Center**, the **Blue Waters Project** at the National Center for Supercomputing Applications at the University of Illinois, and the **Stampede supercomputer** at the Texas Advanced Computing Center at the University of Texas in Austin.

- The construction and launch of the R/V **Sikuliaq** in October 2012, on time and on budget, to provide a state-of-the-art research vessel for scientific exploration of the Arctic for hundreds of scientists and students every year for several decades to come.

- Concurrently with the selection of a new contractor to manage the U.S. Antarctic Program (USAP) for the next decade, we benefited from two key reports: the **National Research Council Report** on science drivers for the USAP, and the **Blue Ribbon Panel Report** with recommendations for more and better science in Antarctica through increased logistical effectiveness. The NSF "Tiger Team" commissioned in response to these reports has already developed a robust set of action plans with clear timelines for implementation of key recommendations.

Nurturing and expanding the innovation ecosystem

- NSF has long played a key role in fostering innovation through the SBIR (Small Business Innovation Research) and related programs, Industry-University Collaborative Research Centers, and Engineering Research Centers. The launch, in July 2011, of the **NSF Innovation Corps (I-Corps) Program**, expands NSF's rich history of supporting innovation arising from fundamental scientific discoveries. The I-Corps Program provides a unique mechanism to extract considerable further value from basic research by providing opportunities for NSF-funded researchers and students to tap into a new, virtual innovation ecosystem at the national level. Within its first two years of existence, I-Corps would support approximately 300 projects and five outstanding groups of institutions and networks of mentors that will serve as the geographically diversified hubs of the national innovation ecosystem. The I-Corps program has also drawn significant interest from other federal agencies, with ARPA-E now partnering with NSF to support several I-Corps projects.

- The **I-Corps** program also helped establish a new paradigm for **public-private partnerships** by partnering with two non-profit foundations with significant experience in fostering innovation.

New Models for Global Engagement

- The launch, in October 2011, of a coherent set of policies and streamlined practices to leverage NSF-funded research within the U.S. with significant new resources from around the globe through the **Science Across Virtual Institutes (SAVI) Program.** Since its launch, 17 SAVI programs have been created involving dozens of countries and hundreds of American researchers, educators and students across the spectrum of activities covered by NSF.

- NSF's leadership role in the hosting of the **Global Merit Review Summit** in Arlington, VA, at the invitation of the White House and the creation of the **Global Research Council (GRC)** in May 2012. This summit brought together, for the first time, the heads of major research funding agencies from nearly 50 countries representing the developing and developed world, and established a new paradigm for harmonizing global science. This event demonstrated the convening power as well as the leadership role of NSF on a global stage. Subsequent to the establishment of GRC, more than a hundred countries have participated in five regional meetings held across the globe by our overseas partners to prepare the principles of research integrity and a multi-year process for collectively addressing the complex issue of public access to publications and data. The next GRC annual meeting will take place in Berlin in May 2013 with NSF serving a pivotal role along with the organizers, Germany and Brazil.

- **An implementation agreement with the European Research Council**, signed in July 2012, to provide new international opportunities for scientific collaboration for a large cohort of early career American researchers with their European counterparts from 27 countries. This program will enable **NSF CAREER awardees and post-doctoral fellows** to work with leading scientists and gain access to research infrastructure in prominent institutions throughout Europe through a streamlined "one-stop shop" process and financial support from partner organizations. It is very encouraging to note that more than 750 indications of interest have already been received from Europe to host these early career scientists even before the program has officially begun.

- The creation of a new model, in December 2012, to provide international experience for American graduate students through the **Graduate Research Opportunities Worldwide (GROW) Program.** This program, announced in conjunction with the 60th Anniversary of the prestigious NSF Graduate Research Fellows (GRFs) Program, will enable many hundreds of graduate students to spend extended research stays at strategically selected overseas partner institutions. The program will also offer new mechanisms for financial support, in partnership with overseas funding agencies, for U.S. graduate students who will work with key collaborators in foreign countries. Since its launch less than two months ago with eight partner countries, the program has attracted many additional

overseas funding agencies to collaborate with NSF. At steady state, the GROW program will leverage several tens of millions of dollars of overseas support to host NSF-funded GRFs in their host institutions abroad.

- The creation, in July 2011, of the **Partnership for Enhanced Engagement in Research (PEER) Program** in collaboration with the U.S. Agency for International Development to link, strategically and in a well-coordinated manner, American scientists with counterparts from developing countries. Within a year of creation of this unique partnership, some 42 projects have been funded through this program. The NSF PEER program is also serving as a model for other agencies to create similar activities tailored to their mission.

- Continued leadership in fostering international collaborations for U.S. scientists, engineers, educators and policy makers with overseas counterparts through such activities as the **Belmont Forum, Partnerships for International Research and Education (PIRE) Program, the Human Frontiers Program, joint funding of projects through the G8,** and **East Asia Pacific Student Internship (EAPSI) Program,** to name just a few among a large number of NSF programs. These activities not only connect early career and established scientists with their counterparts abroad, they also address such global challenges as environmental change, access to clean water, and the mobility of young researchers across national borders.

Principled commitment to human capital development and broadening participation

- *Principled commitment to support the development of young talent for the future scientific health of the country.* This passionate adherence to a core principle, unanimously endorsed by our senior leadership team and staff, has helped **double the number of NSF Graduate Research Fellowships (GRFs)** to 2,000 per year since 2010 (from the prior year) even during the worst financial crisis of our lifetime. These policy decisions, coupled with new programs such as **GROW**, are intended to address the critical need for future science and engineering workforce for the nation. In addition, adjustments have been made to allow for much-needed increases in tuition subsidy and stipend for GRFs. This commitment for human capital development also helped preserve strong support for **NSF CAREER awards and post-doctoral fellowships.**

- *Unwavering commitment to broadening participation and diversity.* Leveraging NSF's experience with such programs as **ADVANCE** and by incorporating best practices for enhancing diversity in the scientific workforce, we launched, in September 2011, the **NSF Career-Life Balance Initiative.** Hosted by First Lady Michelle Obama, this marked the first-ever NSF event held at the White House, and included a joint statement by the leadership of NSF, the Association of American Universities and the Association of Public and Land-grant Universities to work together to foster greater diversity. The importance of the policies and practices accompanying this initiative to be equally applicable to NSF staff was highlighted in a special event held at the NSF building several months later.

Conclusion

It has been my extraordinary honor to lead the National Science Foundation, which is blessed with a marvelous cohort of highly talented and devoted staff, as well as hundreds of thousands of innovative grantees and investigators from every field of science and engineering. I am grateful for the opportunity to serve the country in this capacity and to be the beneficiary of many wonderful life experiences as I witnessed, and played a small role in helping to advance, science over the past several years.

Mr. Chairman, I am most grateful for the strong working relationship with you, with Ranking Member Fattah, and with your Subcommittee. I thank you for your leadership and for the warmth that you have shown me during my tenure at NSF.

I look forward to answering any questions you may have.

[1] Director's memo to NSF staff and contractors, "Transition" dated February 5, 2013

Mr. WOLF. I want to thank you for your testimony. I agree with your word bittersweet. Here is your Congressman coming in, Mr. Rooney. I hope you will live in Mr. Rooney's district and support him. He is going to be the new head of Carnegie Mellon.

But when the staff told me that you were leaving, I was disappointed. It was bittersweet. I said, wow, really? But you have done a good job, and I think you have had a good attitude.

You have always been open, and it is a tribute to you. But, I am not going to say goodbye because we will see you. I am sure there will be a lot of other activities.

Pittsburgh is a great town. I went to Penn State, and when you go to Pittsburgh, you know, what was it called? The Tower of Learning? What is the place out there called? What is it called, the big building?

Mr. FATTAH. The Tower of Rooney.

Mr. WOLF. The Tower of Rooney?

Mr. FATTAH. Yes.

Mr. WOLF. I used to get very resentful of Pittsburgh because I come from Philadelphia and root for the Philadelphia Phillies. My dad was a Philadelphia policeman. And the announcer at Penn State was named Bob Prince, I think his name was. Was it Bob Prince?

VOICE. The Pirates.

Mr. WOLF. The Pirates. No, I know that. But they broadcast the Pirates game at State College. They did not broadcast the Phillies games, which I never quite understood.

But Pittsburgh, it has great representation. I mean, unbelievable. It is really a nice town. They are nice people. They have neighborhoods and a renaissance in the town.

So, Pittsburgh is going to love you and I think you are going to love Pittsburgh. So, anyway, I want to just acknowledge that.

Mr. SURESH. Thank you.

ALLEGATIONS OF WASTEFUL GRANTS

Mr. WOLF. At least once a year, and usually more often, we hear allegations from different folks about frivolous grants. These allegations are then used to make an argument that we could reduce NSF's budget without negatively impacting any important work.

Do you believe that NSF makes any frivolous or wasteful grants? You understand what I am talking about?

Mr. SURESH. Yes. Mr. Chairman, NSF receives tens of thousands of proposals every year and we use a process that brings in experts from the community to select these in a highly competitive environment and more than 240,000 proposal reviews conducted.

I cannot sit here and say that there is not one or two or three times that may not meet everybody's approval. But on the other hand, I think we do everything possible to be sure that these are done in the most appropriate way. These are done to the very, very rigorous standards of NSF.

In fact, the standards are viewed as a gold standard by the global community to such a point that in the last ten years, nearly ten countries have established new funding agencies that are exactly modeled after the National Science Foundation.

And last year when I invited 53 heads of funding agencies—my counterparts—to come at their own expense to the National Science Foundation to talk about peer review, 44 of the 46 invitees came.

So I can assure you that the funding is done through a process that has been refined over the last 60 years which has been viewed as a gold standard, and we do everything possible to make sure that the science is done in the best way.

I would also like to add that sometimes when we look at the titles of these projects and just look at the titles, we may end up with misleading conclusions if we don't go through the outcome of the project.

For example, there was a NSF funded project called Game Theory and Game Theory led to mathematical analysis through which spectrum auctions could be done. The return to the U.S. Treasury from NSF funded Game Theory was $60 billion.

So these are examples of activities where science funding over some period of time leads to unexpected outcomes and I have other examples that I can give you if there is time.

Mr. WOLF. I mentioned Mr. Rooney—you are from Pittsburgh; are you not?

Mr. ROONEY. We are all originally from Pittsburgh.

Mr. WOLF. I know you represent Florida now.

Mr. ROONEY. Yeah.

Mr. WOLF. Okay.

Mr. ROONEY. That is okay.

Mr. WOLF. Okay. Good. You love Pittsburgh. It is a great place.

Mr. ROONEY. Absolutely.

Mr. SURESH. Mr. Chairman, I am learning a lot about the Steelers. They told me not to come to Pittsburgh without knowing all about the Steelers.

Mr. WOLF. And the Eagles, I think, if you are Mr. Fattah.

Because you fund basic research, how can NSF and its grantees do a better job of explaining the purpose and value of its grants to the public? Do you see Senator Coburn has had his reports? There have been other reports. What can be done? How can NSF do a better job of explaining?

Mr. SURESH. So we try our best. We continue to use all kinds of media, all kinds of forums. There are a number of places that I have gone to articulate the significance of NSF funded research. Just last week, we had an opening of a new telescope with 500 people from around the world. I tried to explain to that group what impact NSF funded research has had.

I met with a number of a Members of Congress individually over time, over the last three years, trying to articulate the impact of NSF funded work.

I mentioned at the beginning it is not only my claim, but the data shows that in the last 62 years, 70 percent of all American Nobel Prizes have had some connection to NSF funded research. And it is only a $7 billion agency, so comparatively over all of the enterprises of the U.S., it is a fraction, but its impact is enormous.

I think we could do more. We could do better. It is also a double edged sword, Mr. Chairman, because when we try to articulate the impact of it in layman's terms, that has the potential to be misinterpreted because if somebody just looks at the title that is ar-

ticulated for the lay person, it doesn't fully convey the full impact of the scientific work.

We try to strike a very delicate balance between simplifying the science behind it for common explanation versus running into the cross-fires of misinterpretation of that simplification.

Mr. WOLF. The social science directorate is only a tiny fraction of the size of other major research directorates, which seems to confirm that you also consider social sciences to be a lower priority.

If social sciences should be considered on equal footing with other research disciplines, why does NSF itself de-emphasize social science in its budget request?

Dr. SURESH. So let me first of all say on a personal note speaking as a trained engineer and a scientist, a natural scientist, I firmly believe that social sciences are very much an integral part of the scientific enterprise and increasingly so to address major challenges that we face not just in the social sciences disciplines but also in every field of science and engineering that we face.

The social sciences are unique in certain respects. If you look at physical sciences or geosciences, they require enormous physical facilities and physical infrastructures such as telescopes or ocean going vessels, et cetera. Social science doesn't have those major infrastructure needs even though there are increasing needs for data management, data collection, and longitudinal studies which can become expensive.

So even though the social sciences' budget is only $300 million or so in the NSF budget, increasingly we have activities that interface with every corner of NSF from big data to education and human resources to mathematical and physical sciences, geosciences to healthcare studies, et cetera, et cetera.

So I think I firmly believe that social sciences are an important part of it. I have said that in every statement that I have made during my three years at NSF. And I think some of the grand challenges that we face both nationally and globally will inevitably require integration of perspectives from social and behavioral sciences and economic sciences with natural sciences and engineering.

Ultimately we want to understand the human condition. We want to understand human beings and we want to understand institutions and social, behavioral, and economic sciences provide a unique platform to do that.

Mr. WOLF. As you know, there are usually amendments every year on that issue.

Mr. SURESH. That is right.

Mr. WOLF. And they generally carry.

RETAINING THE RESULTS OF FEDERALLY FUNDED RESEARCH

Last year, the subcommittee held a hearing on American manufacturing and job repatriation. One of the findings that came out of the hearing was that technologies developed partially or even solely through the use of Federal research funding often end up manufactured overseas. That means we are allowing foreign economies the benefit of our research dollars.

Are you aware of instances where this has happened among NSF grants?

Mr. SURESH. The way that NSF grants work is we fund the universities, but the universities own the intellectual property and then they license it. In fact, with engineering at MIT, a lot of the intellectual property portfolio reported to my office in the School of Engineering.

So NSF doesn't directly engage in the licensing of this technology at universities and colleges because of the Bayh-Dole Act, so we leave it up to the institutions to comply with the federal regulations, export control, et cetera, et cetera. And so this is given a lot of careful thought at various universities.

Mr. WOLF. But do you have any policies in place that would help to minimize or eliminate that? Could there be some conditionality on the grants to say that if commercialization takes place, the preference ought to be with an American company to keep that technology here and also to create jobs here?

Mr. SURESH. Given the fact that by law the ownership of these intellectual properties reside not with NSF but with the recipients of these grants, it is very difficult for us to individually prescribe solutions to that.

One of the things we have done with respect to the I-Corps program, for example, we tried to develop a virtual national network so that the vast number of scientists and engineers and students at American universities that don't have the access to the ecosystem, for example, people in the Midwest who may not have access to the venture capitalists on either coast, using NSF's convening power, we can bring them in touch with them. We can put them in touch with them to give them greater opportunities. This is something that we are trying to do.

Mr. WOLF. But shouldn't there be some mechanism so that if Carnegie Mellon or Penn State were to take an NSF grant, conditionality would require that manufacturing or technology from that grant be kept here?

You know, America is struggling on these things and we are subsidizing technology that later perhaps—as we see in the solar now, China is moving ahead in solar—will be gone abroad.

I went to Penn State University, a great engineering school. If Penn State takes a grant that then turned into a manufacturing technology, shouldn't there be some language or something to say that there ought to be a first refusal or something from an American company rather than a foreign company?

Mr. SURESH. Well, from my experience in dealing with these at the School of Engineering at MIT, sometimes there are well-intentioned prescriptions that lead to a lot of unintended consequences.

For example, if General Electric, or some other American company, were to license the technology, 75 percent of the manufacturing is in the U.S. and some part of the manufacturing is somewhere else, say Mexico or some place. Would that be beneficial to the technology or detrimental to the technology?

Should all of them be in the U.S.? I mean, there are so many little details. I think perhaps it is probably a good idea to look at it, but I will be happy to look into this. My experience has been that every time we prescribe something with one intention, there are some unintended consequences that emerge out of this.

Mr. WOLF. Well, I would like you to look at it. You know, I was raised in Philadelphia, and I lived next to the largest General Electric factory, I think, in the country. As I go back to my old neighborhood, it is gone. It is over.

GE has now moved their MRI imaging that you see their ads on. They are leaving Waukesha, Wisconsin. Now, I do not know if NSF was involved in that. They are leaving Wisconsin and going to Beijing. And Americans are watching this and I think the question is are American tax dollars leaving?

So, obviously we are a global society. And some things may be manufactured overseas. But we can't have a raw Federal dollar go to a locality, go to Penn State, Penn State then takes it, develops manufacturing technology, and then it is being done offshore. Then somebody in south Philly or Harrisburg or out in the Winchester area in my congressional district does not have the opportunity.

Mr. SURESH. Most of NSF funding is for basic research. So between the time the NSF funding is over and whatever emerges out of it to the time the technology is developed and then is ready for commercialization or manufacturing, there is a large time gap involved. That requires significant additional investment beyond what NSF has given. And sometimes it is a few years.

So at the end of the NSF grant, some technology emerges that is further developed that leads to a small business and the small business receives funding from a number of different sources and then that leads to a process, software technology that leads to some kind of manufacturing. So there is a long time gap.

NSF's role is primarily basic research. So what NSF does and what eventually happens in a company like GE, there is quite a lot of things that happen after the termination of the NSF grant.

That is one of the reasons it is going to be very, very difficult for a basic research agency like the National Science Foundation to give prescriptions on what should be done with the output because the output of NSF research and the input that leads to manufacturing, there is a lot of development in between.

Mr. WOLF. I understand. I am going to go to Mr. Fattah. I understand, but GE is now producing some aircraft parts and engines in China. That probably all came out of DoD funding, which could have earlier come out of an NSF grant or some other grant.

And I just think, America is going to go into decline. We are broke. We have tremendous debt. We have a tremendous deficit. And all this manufacturing leaves. So I think anything we can do to keep it here in the United States is appropriate.

There are no easy answers, but I would like you to really look at it, because it is not appropriate to take the tax dollar from an American citizen and then find that the resulting job, the technology, the manufacturing is in Bogota or some other place like that.

Mr. Fattah.

Mr. FATTAH. Thank you, Mr. Chairman.

And I wanted to cover three subjects. One is the subject that you are just concluding on. I want to spend some time on that for a minute.

And I do want to then talk to you about the global competitiveness of the American efforts in science vis-a-vis some of our com-

petitors and then I am going to finish up on neuroscience which, of course, is my number one focus and subject.

But the chairman started here, so, you know, I have learned something from the chairman which is that commissions and bringing people together is a very good idea. And so I introduced a bill, H.R. 614, which is American Discoveries, American Jobs, and it deals with this issue that the chairman just raised.

It has nothing to do with the National Science Foundation. Across all of our agencies, NASA, which has got thousands of patents, NIST, all of our various agencies, we fund a lot of research. And a part of this research eventually does lead to progress and sometimes that progress means, you know, some new way to make a widget and the manufacturing of these items. There are federal labs where we have, not through NSF, but through DoE, we have funded. They have come up with things. And the new widgets are being manufactured in far places.

You know, the notion that we should tax a waitress this morning in some restaurant in D.C. and fund research, I am all for. I really do think we should fund research. I am for big science. I am for us investing money in science. But I do think that we have to make sure that we are as relevant as possible and responsible to the American public here.

So, you know, scientists have this desire and almost responsibility to want to be open sourced and want to collaborate and want to interact with their international counterparts and then, you know, but in a competition, you know, and I am talking now about the economic competition between the United States and others who would like to eat our lunch economically, we have to be a little more—it is like the Steelers. They do not put their play book so that other teams can see it. I mean, you try to like figure out what you are doing and perfect it, right, to your own interest?

So to some degree on some of these economic issues, the country has to be a little more parochial in some of these areas, right? So we have lost, you know, some ground in an area. We make some investment. We pick up some ground. If we did share that with everyone who we are competing with, you know, really we are working at cross purposes.

And I know this is hard to reconcile between the way scientists work and the way people who have responsibilities for our economic competition might think about these things. So I think that we have to do better at this.

And, you know, major research universities, whether it is Carnegie Mellon, whether it is University of Pennsylvania, the great universities have benefitted because they get research grants from the Federal Government. Their faculty and students do work. The university owns the intellectual property. We do not have any problem with that.

The issue becomes is I believe, Mr. Chairman, there is a way that we can tie the fact that there were federal investments originally in that work to the responsibility that if the intellectual property is going to be utilized, that those jobs end up in the United States of America.

You know, I think there is a way to get there from here. I am not a lawyer, but there are plenty of smart enough lawyers to fig-

ure out how to do that because a grant is a grant. It is free. We are giving some scientist the money because they have a great idea. And that idea might eventually lead to, you know, to making people's lives better and they might even make millions of dollars or billions of dollars.

But in the meantime, we want the jobs that emanate from that. Whether they are in Mr. Rooney's district or mine or even in Texas, you know, or Virginia, I mean, we want those jobs, you know, in the United States of America. So I think it is a reasonable proposition. So that is number one.

I have some legislation in that regard and I think the Congress—I am not sure scientists can work this out because, again, the impetus for—the notion is that you have this great desire to share all this information with everyone and interact with your colleagues around the world, but we have to think about this in a little more guarded way, particularly in this area of manufacturing.

This is critically importantly and if we develop techniques, we develop materials, we develop approaches—I was out at Oak Ridge looking at this additive manufacturing. It is amazing. But if we are going to develop it and then just share it with everybody the next day, you know, it does not give our workers the kind of advantage that they need.

Mr. SURESH. Mr. Ranking Member, first of all, you used a Steelers analogy and I am not yet fully up to date on the Steelers, but I will be before too long, and I will use better analogies than I can do right now. I have been trained with the New England Patriots for almost two decades, so it will take me some time to migrate over.

I want to make a few points in response to that. First, Congress actually asked NSF in 1977 to be the very first federal agency to start the SBIR program. In hindsight, we would not have thought of NSF as being the destination for the creation of the SBIR program, but Congress asked NSF to do it in 1977.

Here is what came out of it. NSF gave small grants to companies like Qualcomm. In fact, I have on videotape the Co-founder of Qualcomm, Irwin Jacobs telling us that he got a small grant of $125,000 from NSF when they had 10 or 15 people on the company payroll. Now they have 21,000 people. Another company is Symantec which now employs 18,000 people.

NSF over the last several decades as the federal agency to start an SBIR program has nurtured American innovation and American manufacturing on American soil. There are lots and lots of examples.

Even the last couple of years when we started the I-Corps program, some of the initial grants were $50,000 that we gave. We have a company, a small company, Professor Strader, that was just bought out by Drop Box in the U.S. There are many, many examples of this. So that is the first point I want to make.

The second point is that we do have as a basic research funding agency responsibility for research and education and STEM education. We do fund activities that contribute to that in a major way.

For example, in the EHR directorate, we fund a program called ATE, Advanced Technological Education, to the tune of about $64

million a year. That supports community colleges in technological education. In fact, it trains American undergraduate students in community colleges to learn about things like manufacturing, not all of it, but some fraction of it.

Mr. FATTAH. Well, thank you.

Again, my proposition is simple. American Discoveries, American Jobs. To the degree that we finance the discovery, the jobs should be here. And there is a lot of how to get to that from here which is why I introduced this legislation to create a national commission because it will require some work to think through how to do this.

But I do believe we can get there. We do not have to finance work that then leads to tens of thousands of jobs being created among people who are competing with us economically while our own people do not benefit from those jobs even though they were taxed originally to finance the research.

So I think there is a way in keeping with our commitment to build these major research universities and to have this effort, I think the chairman is absolutely right.

INTERNATIONAL COMPETITION IN RESEARCH AND DEVELOPMENT

So let me move on because I wanted to make sure that we preserve some time. In your original testimony before the committee years ago, you talked a little bit about the fact that the United States, you know, had challenges in terms of scientific competition around the world ranging from much smaller countries like Singapore to much larger countries with multi billion populations and that we needed as a country to be thinking more aggressively in terms of our investment in science.

I want to give you a chance in your last visit to comment on that before we move to neuroscience.

Mr. SURESH. Sure. I think our biggest problem is our inability to plan ahead. For example, when I discuss projects with our counterparts from around the world with whom we are vigorously competing, they are able to plan for five to seven years.

Take Europe as an example. Europe is in the middle of a deep financial crisis from Greece to Italy to Spain to Cyprus to Ireland to you name it. But still the European Parliament is right in the middle of discussions of a funding project called Horizon 2020, that will, over a seven-year period, lead to somewhere on the order of 60 to 70 percent increase in science funding because 27 European countries unanimously feel that this is so important for the future.

Singapore as an example, a country that I have interacted with in my previous job quite a bit, and they plan for many years ahead of time. China has a five-year plan. Look at Germany. The German National Science Foundation, which is my counterpart agency, has a guaranteed five percent annual increase for the next five years guaranteed by the Chancellor of Germany.

It is not the amount of money, it is the lack of certainty for planning. We not only don't have annual planning, we are still in a Continuing Resolution for the fiscal year that began last October 1st. I think this really potentially undermines the credibility of agencies like the National Science Foundation when we try to compete when science inherently requires long-term planning and this is a major problem for us. It continues to be a problem for us.

Mr. FATTAH. Thank you.

I was talking with the chairman last evening on the floor about the European Union's Horizon 2020 because they have among their six focus areas that they are going to make these scientific investments, they decided that neuroscience is going to be at the leading edge of their activities.

And yesterday at lunch with the Prime Minister of Ireland who now has the lead for the EU for this year, they change leadership every year among these 27 countries, but Ireland has the lead and they are taking this effort around neuroscience very seriously.

NEUROSCIENCE

So this will make a good transition here to this point. So I want to thank you for your leadership. The committee had instructed the OSTP to create a collaboration on neuroscience. I want to again thank the chairman for his help with us and his leadership on this and along with our Senate counterparts, Thompson, Hutchison, and now Chairwoman Mikulski. We were able to get this done.

But NSF co-chaired this collaboration. I want to thank you and your team. I take note of the dear colleague letter that went out in March, on March 4th around a very significant effort of the agency neuroscience. I know that the collaboration is going to issue its report in June.

But I cannot think of any other way to say it, but I think that the only way that we would have made this progress up to and including the President's talk at the State of the Union about the brain mapping effort is because of the great contribution of your agency——

Mr. SURESH. Thank you.

Mr. FATTAH [continuing]. In this regard. So I want to thank you for what you have done and what the NSF will continue to do in this regard. But if you would like to give some comment on this effort, please.

Mr. SURESH. Thank you. And also I want to thank you and the chairman for highlighting the importance of neuroscience. As you know, the U.S. National Academy of Engineering about six years ago released the 14 grand challenges of the 21st century.

One of the grand challenges is reverse engineering of the human brain. There are so many applications from education to learning how people interact, bringing the biology of the neurons in the human brain connecting that to the psychology of the human mind. It is a grand challenge and I think this is one of the frontiers of exploration and discovery where the tools that we have will position us to make some phenomenal new discoveries in the future.

This is something that takes place at NSF in many different offices and directorates. And I think all indications are that we will continue to grow in the years to come given the importance of this topic.

Mr. FATTAH. Well, thank you.

And I thank the chairman.

You know, our effort, you know, obviously the most important one to date, there has never really been this kind of a high priority collaboration among all the federal agencies, but I do not think it

could have been done without the leadership of the National Science Foundation's co-chair along with NIH in this effort.

The European Union has decided to make this the year of the brain. They are going to have a major conference in May. I was telling the chairman I am going to participate in in Dublin. I am trying to convince the chairman to come with me. We can visit with our counterparts.

They have decided to put about, and I do not want to say an exact number because Parliament is still debating this to some degree, but somewhere in the range of 100 to 200 billion euros into this effort on neuroscience. And they want to make as one of the principal pillars of it is collaboration with the U.S. because this is important.

So diseases, disorders of the brain, there are hundreds of them. We are literally nowhere in terms of getting to some effective treatment. We have traumatic brain injuries. And I know my colleague, Mr. Culberson, who chairs the Veterans' Affairs Committee, is quite aware of the fact that some 40 percent of our returning veterans who have been injured have brain injuries. This is a big issue for us.

But also on the operations or the functioning of the human brain when it is well is something we know little about. So this is a great scientific endeavor that can lead to a great deal of progress in our country.

So I thank you and I wish you well in your new efforts at Carnegie Mellon. So, you know, between MIT and Carnegie Mellon, you are able to stop off here in Washington and do some great work for the Science Foundation. So we thank you for it.

Mr. SURESH. Thank you.

Mr. WOLF. Thank you, Mr. Fattah.

You know, maybe we should put your commission into our bill this year.

Mr. FATTAH. I like the sound of that.

Mr. WOLF. A lot of the authorizing committees are not passing very much, but maybe we should do that. And I appreciate the effort on brain science.

I think that your comment about the spending—to set aside a certain amount—has so much sense.

My wife and I, we have 16 grandkids and I worry about the future of this country. If we do not do something bold like the Simpson-Bowles Commission, I think this country is going to go into decline.

We had Niall Ferguson here last year and he said when great nations decline, they decline rapidly. I do not want us to decline. I want my grandkids to live in the greatest nation in the world.

I think about what my mom and dad and my grandparents, who were immigrants, did, and I see the hassle and the argument in this town. We are just descending rather than ascending. Every politician loves to say America's best days are yet ahead and the sun has barely begun to rise on the country. I want that to be the case, but in order for that to be the case, there are things that we have to do.

Mr. Culberson.

Mr. CULBERSON. Thank you, Mr. Chairman.

I want to thank you, Dr. Suresh, for your service to the country, all you have——

Mr. SURESH. Thank you.

Mr. CULBERSON [continuing]. Done for the National Science Foundation and in the work that you have done in collaboration with young people. I notice we have got a group of young students that have been rotating in and out. And I have been trying to read your shirt, inspiring leaders in technology and engineering.

What school are you all from?

VOICE. Battlefield High School.

Mr. CULBERSON. Fantastic. Obviously——

Mr. WOLF. Battlefield? I know where that is. Welcome. Why don't you come by my office later?

Mr. CULBERSON. You all are well represented. Mr. Wolf has done extraordinary work in preserving the Nation's investment with Mr. Fattah and the subcommittee to make sure that National Science Foundation has stable, predicable funding for the future, that the NIST, NASA, all of the extraordinary, incredible scientific achievements have made this Nation what it is will continue to be funded in the future and to particularly bring young people like you all up into math and science.

LEGACY OF DR. SURESH'S TENURE AT NSF

Could you talk a little bit about the legacy you would like to leave for the future for NSF, the collaborative work that you have done already and hope to see continued with high schools like Battlefield, young people like these that want to go into the sciences and engineering and what should this subcommittee do to help or support that work that you have begun.

Mr. SURESH. Thank you, Mr. Culberson, for giving me the opportunity to say that.

Let me just make a personal comment from life experience. I came to the U.S. in 1977 after receiving my undergraduate degree from India Institute of Technology. When I finished, I was 21 years old and there was no question in my mind what my next step was. I didn't have to sit down, ask anybody what I should do next, where I should apply for a job.

Automatically the obvious path for me at that time was to come to the U.S. to do graduate education. So I got on a plane with less than $100 in my pocket and a suitcase and went to Ames, Iowa.

I think if we can keep that for people from around the world, the destination to do science and engineering is the U.S. If our universities and colleges can keep at the forefront, then we will have our scientific enterprise not decline in our lifetime or in our children's lifetime.

After I finished my Ph.D., I was a professor at Brown University for ten years. My first major grant that pretty much guaranteed my research work, research path and my tenure and full professorship at Brown University was an NSF grant.

Mr. CULBERSON. Remind us and the young people here your field of study.

Mr. SURESH. I received all my degrees in mechanical engineering. NSF was the preferred destination to seek support. It was $100,000 a year for five years, something called the Presidential Young In-

vestigator Award. I received a letter from President Reagan which is still in my office at NSF and that pretty much guaranteed my move.

So you asked me what your subcommittee can do and what NSF can do. I think we can make sure that young people who want to do science and engineering have the opportunity to compete in a fair way for grants of the National Science Foundation, and the National Science Foundation has enough resources to support them because we receive far more proposals that are of the highest quality than we are able to support with the resources that we have. I think this is why it is so critical that we continue that support.

Mr. CULBERSON. And I think the chairman's bill this year that the Senate I hope will pass, there will be language in there that encourages NSF to create a pool of funding for competitive peer-reviewed grants that would encourage collaborative research between science technology high schools like Battlefield and others and like Thomas Jefferson with universities.

Talk a little bit about that. I hope that is something that you have been pursuing in the time you are at NSF.

Mr. SURESH. Well, you know, we have a number of activities that involve undergraduate education, for example, especially in STEM education. We have a number of activities for K through 12 programs. The Discovery Research K through 12 program is one example of this.

I think it is important to find the mechanism to engage young kids and start them at an early stage. I think in testimony in this room a couple of years ago, we talked about at what age do children become passionate about science and engineering. It is the first grade level.

I think we don't want them to lose that interest in science and engineering. Given all the pressures on NSF funding and the increasing demand for limited resources from the National Science Foundation, we are trying to do everything possible to make sure that we not only reach out to undergraduate students but also to K through 12 STEM educators.

This is why one of the reports that the chairman helped commission through the National Research Council; we have been disseminating it around the country, holding different events, talking about this, and what the National Science Foundation can do to help in that.

Mr. CULBERSON. You mentioned that the $100,000 grant over—$100,000 a year for five years was so decisive in your career and the work that you have done. I hope the subcommittee will consider putting language in our bill that frankly just creates a pot of money out there for STEM high schools to do collaborative research with universities because it truly can be transformative, particularly in, you know, some of these really good science high schools across the country.

There is such a great opportunity for you all to do work with university researchers and if NSF can help fund in a peer review competitive fashion as all other grants are done, some of these really bright young people that are in these great high schools to do collaborative work with universities, I think it would help immensely and there is no better way to do it than with a grant program.

And you also mentioned stability and predictability. And I did want to ask you as this is your final appearance before the subcommittee. I am working through a really interesting biography of Hyman Rickover on the work that the chairman and I are doing on trying to reform NASA, giving them greater stability and predictability.

But would love to work with you, Mr. Fattah, on this and giving that agency a little more freedom, make them a little less political, more professional as you are, sir, in the way that they are governed and the ability to do multi-year procurement. And NASA has got a lot of problems, and I am convinced as the chairman is and all of us that love NASA and care about it, is a lot of its governance and a lack of stability.

Talk to us, if you could, about—because Rickover was always interested in problems. Whenever he met with his people, they would try to give him glowing reports. And he was like I do not want to hear about all the good stuff. I will find out about that later and everybody is going to take credit for that.

Tell me about the problems. As you leave NSF, talk to the subcommittee about the problems and in particular obviously the stability, predictability and how we in Congress can help resolve that for the future.

Mr. SURESH. I think, given—we discussed earlier pretty much about every one of our competition agencies from around the world, agencies with whom we compete, and increasingly we compete for human talent because it is now global.

If we cannot attract the best scientists to come and work on one of our NSF funded grants, the German National Science Foundation would provide a mechanism for them to go to one of their institutes or some other university in Germany.

I think the stability and predictability is an issue. The second, because I think, especially in this economic climate, one of my biggest fears is that young people who are really interested in science and engineering will get so disillusioned and turned off that they will leave science once and for all.

If that happens, I think that is going to have a very detrimental effect on the future of the scientific enterprise, and this is one of the reasons we made a principal commitment during my tenure at NSF that no matter what the budget uncertainties are, we will not cut back on our commitments to graduate student fellowships, postdoctoral fellowships, young career awards.

We decided that those are things we will protect to the fullest extent possible and that is one of my biggest worries that it is partly psychological, but it is also partially based on reality. And that is something that I worry about.

In fact, when I visited Carnegie Mellon just a few weeks ago, most of the questions I received from students was that if I want to go do a Ph.D. and do research, what is the opportunity because they were asking me in my capacity as NSF director what did I see will be the future for them and whether it is a good idea for them to stay in science or do something else. Is it a good idea for them to stay in the U.S. or look for job opportunities all over the world?

So that is my biggest fear. Anything the subcommittee or Congress can do to assure the young people that the future is still very

bright and for people like me who came to do science—and I took up U.S. citizenship in 1989—and that opportunity exists for future generations. I think that is the best contribution that can be made.

Mr. CULBERSON. We will do our best. Thank you.

Mr. SURESH. Thank you.

Mr. WOLF. Mr. Rooney.

Mr. ROONEY. Thank you, Mr. Chairman.

And I was actually born near Mr. Fattah's district there in northeast Philly, but all my people are from Pittsburgh, my parents and brothers and sisters, but——

Mr. WOLF. You were born in Philadelphia?

Mr. ROONEY. I was, in northeast Philly at Holy Redeemer Hospital which I do not know if it is there anymore. But I was raised in Villa Nova. But, anyway, that is not what the witness wants to hear about.

Actually, I am glad you are going to CMU. I was not smart enough to get in there, but we did CMU in football which was probably the most important thing for me at that time in my life.

The story you just told about, you know, your life was great. And I think that it really shows especially the young kids that are coming in the room the American dream sitting in front of us.

And somebody who is trying to figure out Pittsburgh Steeler football, it took my grandfather 40 years to figure that out, so, you know, you have time. But he also lived the American dream.

MANAGEMENT OF COOPERATIVE AGREEMENT

And the chairman, you know, spoke of it, what we are all concerned about with regard to the future and our children and where we have been and where we are going. And our economy, as you know, is, and as everybody in this room knows, is in turmoil and trouble right now and we are trying to figure out as a Congress and as a government how to move forward.

And a lot of times when Members go on to the House floor when we are trying to figure out where to cut spending and, you know, it might be easy for me to cut NSF spending in somebody else's district and, you know, it makes me look good back home in my district.

And so when we try to justify what we are appropriating and what we are cutting, you know, one of the areas—I am just going to read something to you and I would like to get your reaction to it because it does trouble me a little bit and I think that it would help all of us when we do try to justify how we are spending the tax dollars.

And NSF's OIG stated in its September report to Congress that it is an ongoing challenge for NSF to establish accountability for the billions of federal funds in its large cooperative agreements which as of last year totaled $11 billion.

The report also stated that NSF does not require or conduct adequate pre-award audits to ensure that projects have reasonable budgets and that NSF has serious weaknesses in their post-award monitoring for high-cost, high-risk projects. Billions of dollars are at stake and the OIG strongly recommends that NSF strengthen its cost monitoring of BCAs and other grant awards from the grant proposal to the closeout of the award.

So if I could get your reaction as you leave before. What is the plan for that for your successor and why haven't we done what the OIG has recommended or why haven't we been doing that already?

Mr. SURESH. Very good questions. First of all, thank you for giving me the opportunity to respond to this.

We take all of these comments very, very seriously. In fact, to the point that our chief financial officer is sitting behind me and her whole team have been in almost weekly meetings with the IG's office.

Part of the reason is that for audit resolution, we follow the A-50 circular. OMB had issued a circular a year ago that said that NSF's procedures meet established federal guidelines.

So part of the difficulty here is that there are a lot of one-off procedures, one-off facilities that come into existence that are not standard practice. That is one of the reasons why NSF has historically done these projects the way it has.

We do that by a peer-review process, but we take each of the comments of the IG's office very, very seriously. We have had a number of responses that BFA has prepared to address some of the concerns that the IG's office brought up.

Part of the challenge in this is the IG's office has looked at one aspect of the way we do large facilities. So many of these policies and practices came into existence when NSF was a billion dollar agency. Now it is a $7 billion agency.

We have to look at, so do we want to address one issue that the IG brings up that may have an unintended consequence somewhere else? To make sure that we address it correctly, last December I commissioned a federal study of everything that NSF does related to large facilities.

I appointed one of my senior advisors to go to all the federal agencies to talk to them about their best practices from NASA to DoE to Homeland Security, meet with OMB, not just the science side of it, but the business side of it, OSTP, DoD, and we invited people to come to NSF.

It is my intention to finish the study before I leave which is three days from now. There is a preliminary report of this. It will be done and it will be handed to my successor. There are recommendations on what we could do.

This is something that will come up for discussion with the National Science Board in their May meeting. We have been following up these things.

There are some established practices that are unique to scientific science funding. There are things that we could change and we want to look at all of them before we decide what is the best path to move forward.

The good news is that in response to those comments, in response to a number of other things, not just from OIG, but how to do business better in the most efficient way and how to have the fullest level of accountability and audit capabilities, that this study will be completed. It is actually in the very final stages and I will finish it before I leave.

Thank you.

Mr. ROONEY. Thank you, Mr. Chairman.

Good luck.

Mr. SURESH. Thank you.
Mr. WOLF. Dr. Harris.

H1B VISAS

Mr. HARRIS. Thank you very much, and it is good to see you here on the other committee that has to do with NSF.

Because I consider, you know, like in the medical field, we have the surgeon general, I consider you kind of the scientist general of the U.S. Government. Okay? You are the head of the NSF.

So you should be looking at what the country is doing in terms of its policy to make sure that we stay leaders in the world in science. And I think that is one of your roles.

And maybe this chance now three days before you depart is a chance to say what might be really on your mind about some things.

And I am sorry I have to step aside to the other subcommittee for a few minutes, so I do not know if you discussed the future of our ability in America to attract foreign talent.

I am going to be very specific because, you know, as a scientist working in government, I consider myself, you know, as a physiologist, a scientist, and you must be frustrated because, you know, to us, two plus two equals four every day of the week. It is one of those triple equal signs, always equal to four.

And we find we come to Washington and two plus two is whatever the subcommittee or the committee or the body says it is on a given day. It could be three. It could be five. It is whatever the majority says which is a little frustrating because as I view the problems with attracting foreign talent, my first concerns came to me when I was on the faculty at Hopkins.

And I just visited NIH yesterday and their concern is, you know, with the sequester cuts, oh, my gosh, how are we going to keep young people in the field as I am sure your concern is.

And I recall a case a few years back where we had a very promising person who came here from the UK, did research in the lab, very high-quality research. And when his time was up on his training Visa, he could not get an H1B Visa. Actually, instead of going back, he found another program where he just did not do research. He did clinical work and that is where he ended up. So here is someone we lost to research because of the faults of our program.

And then in my district back in Maryland, we had Martin Marietta. I went and visited. They said, look, part of our problem is we cannot get engineers, we cannot get people trained, you know, we have frustration with the H1B process.

Last year, famously Steve Jobs before he passed away, you know, the head of one of the greatest success story companies in America, Apple products, says this is not the difficult problem. We really need to increase and make it easier for us to get H1B Visas.

And here we are. I have been here two and a half years. I think the H1B Visa quota is exactly the same as it was. It may have increased a little bit. But, I mean, we are talking about it should be doubled, maybe even more.

And, you know, the Administration, the President said, look, because we have had free-standing bills, everybody looks at this and two plus two equals four. We need to change the H1B program if

we are to retain our preeminence in the world and especially because we are spending our dollars—for instance, some of your grants go to departments where we train postdoctoral fellows to go back and compete against us.

I am not sure, Mr. Chairman, how that is efficient, how that is an efficient use of our money. We are literally taking our taxpayer dollars to train our competition, giving them no chance to do what you did and my father did which is to say I actually want to come to America and participate in this economy.

Do you think that is a wise decision to say it is all or none, we either get H1B as part of comprehensive reform or this country just does not need it?

Look, comprehensive immigration reform is a laudable goal, but it is a tough goal. H1B reform is probably a chip shot. I mean, the President admits we need it. Business leaders admit we need it. I think we have bipartisan agreement we need it. We should be attracting these individuals.

This is going to be very simple. Do you agree with the Administration on this?

Mr. SURESH. The whole issue of immigration is not only an intellectual exercise for me, but I have lived through it. In 1982, I was post-doc at Berkeley in California and I couldn't leave the country for eight months because my passport and Visa status was in limbo. I mean, it was being processed, but I was waiting for a response from the immigration office.

And so I think to go back to the early part of your comment, one of the reasons I think the scientific enterprise of this country has been so powerful and the U.S. has been the unquestioned innovation leader at least since the second World War, is because we were the unquestioned destination for people from all over the world to come here voluntarily.

If we lose that, we lose our scientific leadership and, therefore, we lose our economic leadership and security, military leadership. I can give you a couple of examples of this before I come to your point.

It is a very complex factor because, when I graduated from college and came to the U.S., we had a very well-known undergraduate institution. There were 250 of us graduating in all fields of engineering that year in that campus.

Out of 250, more than 200 came to the U.S. from that one campus and all of them stayed here. The vast majority of them became U.S. citizens. And that is because at that time, that was the right thing to do. That was the best opportunity.

Thirty-five years later, same campus, still about 250 students graduating every year in engineering, probably much better quality now because of competition compared to my graduating class, probably 15 to 20 percent of them even bother to apply. If 80 percent of them applied, they would get in, but they don't even bother to apply because they have opportunities elsewhere.

I think this combined with the fact that if there is significant lack of opportunity or perceived lack of opportunity for either jobs or in STEM fields, then I think it is going to have a huge detrimental factor.

A couple of other really quick data points. More than one-third of all the American Nobel laureates since the second World War came here as immigrants. You take the National Academy of Sciences which is about 2,100 living members, about 25 percent to 33 percent of the members of the American National Academy of Sciences are foreign born. Some of them have done their pioneering work abroad. So I think if we lose that ability to attract, it will be a detriment.

One other point in the late 1990s when many of the small businesses started in the Silicon Valley, about half of all the CEOs of small companies with at least 100 employees were foreign born. So I think that has been historically the way this country has operated.

Regarding what is the best way to address the issue, do you give green cards to all those who get a Ph.D.? It can help. It will help. But I think it is much more of a complex issue. It is a complex issue because when I first came here and when I decided to stay here, when I decided to become an American citizen, and at the time I decided to become an American citizen—the U.S. would have allowed me to keep a dual citizenship, but my country of birth would not allow me to keep my citizenship. It is a very emotional decision.

I had to look at a lot of factors to consider. And I think there are many factors that play a role in this decision on whether we are able to attract talent or not. What are the opportunities for young people that choose to come here, whether we have green cards or not. Do we have enough funding? Do we have enough jobs to support them? Do you have a system that nurtures talent the way we have done for 60 years? We continue to do that. What kind of hoops do you have to go through to get a green card?

In my case, there was absolutely no problem or question. I have always been a stickler for abiding by the law. It took a year and a half and I couldn't leave the country for a year, for most of that time.

Are people willing to put up with it now when there is so much easy mobility of people around the globe and much greater opportunities? So I think it is a combination of a lot of these issues rolling into one decision. And definitely the opportunities are much greater now around the world than it was when I was looking at opportunities here. So that is my response to your point.

Mr. HARRIS. And let me just follow-up a little bit. Okay. As the scientist general, what would you advise Congress to do on this issue?

The ability to attract talent, that is young talent, that is frequently educated here, how should we deal with the issue of allowing them to participate in our economy?

Mr. SURESH. I think providing opportunities for highly-trained, highly-talented people to compete in a fair way without too much bureaucracy to reside here permanently is one welcome step.

Another would be removing some of the uncertainty related to the future. I think part of the problem when a student starts a four or five-year Ph.D. program in STEM, it doesn't matter whether it is an American student or a foreign student, in an American uni-

versity, they have no idea, their professors don't have any idea right now whether they will have sustained funding for five years.

We discussed this a little bit when you had to step out. But I think one of the biggest problems for us as a funding agency is not the amount of money itself, but the lack of certainty about next year or the year after that. Even last October, we still are in a Continuing Resolution.

I think removing some of the uncertainty—if Congress can create a multi-year budgeting process, especially for agencies such as National Science Foundation, which look at multi-year future—I think it will be extremely beneficial. So those are some of the things that come to mind.

Mr. HARRIS. Thank you very much.

Thank you, Mr. Chairman.

Mr. WOLF. Mr. Schiff.

Mr. SCHIFF. Thank you, Mr. Chairman.

EARTHQUAKE RESEARCH

Director, I wanted to ask you about a couple of subjects. One of them is about something near and dear to our hearts in California and that is earthquake research. This is not only a problem and a threat in California but an issue in communities throughout the country. Investment in earthquake research can ultimately save billions of dollars in infrastructure damage.

Can you tell me a little more about the research that NSF is currently supporting to better understand earthquakes as well as any future plans for investment in this area?

Mr. SURESH. NSF supports a lot of activities in earthquake research to give American scientists an opportunity almost in real time to do analysis, prediction, mitigation studies and so forth.

In California, for example, a number of us here visited last September at UC San Diego. There is an earthquake simulation center that NSF has funded for a long period of time. That is one type of activity.

There is a George E. Brown Jr. Center for earthquake studies. It used to be in California. It is now at Purdue. And that is another activity that the NSF has supported for a long period of time.

There is a network called IRIS. It, again, is one of those NSF acronyms. What matters is the S in the IRIS. S stands for seismology which consists of about 140 institutions in 80 different countries where there are poles in the ground.

If there is an earthquake happening say in Italy or in Japan or in New Zealand, the signature from that earthquake, even the signature preceding that earthquake will be recorded in a number of institutions in the U.S. NSF has supported the IRIS program for a long period of time and it is a real-time network.

There was an earthquake in Christchurch, New Zealand a couple of years ago and then in March of 2011, the people running in Japan with the earthquake, tsunami, and the nuclear disaster. NSF has a mechanism called RAPID where we very quickly fund projects with almost no bureaucracy in the Federal Government where we quickly send the money out so that American scientists have immediate access to the damage zones so that they can study before it is too late to gather data.

This is something that we have fostered for a long period of time.

Mr. SCHIFF. Have you been involved, Director, and I know there have been efforts in California and elsewhere to develop early warning systems? We are not at the point of predicting earthquakes yet, but we are at the point of giving sometimes half a minute or a minute of notice.

USGS I know does some work in this area. Does NSF work in this area as well?

Mr. SURESH. Well, we fund the fundamental research in all of this. For example, it is not just with respect to earthquakes, but also tornado forecasting, to do advanced warning to people, especially now with mobile devices.

The way in which we can give advanced warning is very different from previous modes of a phone call on a land line or through the radio broadcasting system. Now we have additional vehicles.

And especially with things like GPS and a mobile device, we not only can give a warning to a citizen in an earthquake affected area, we also know from GPS where they are so we can target the type of warning to the type of location based on the geographic location.

There is a lot of research that NSF supports, the output of which works in conjunction with what other agencies do, like USGS and other agencies; NOAA, can be extremely beneficial. There are many of these activities that NSF supports already.

SUPPORT FOR LARGE RESEARCH FACILITIES

Mr. SCHIFF. Let me ask another topic and that is one of the things that NSF does which is a great responsibility—is it funds and supports large scientific research facilities that provide data that is important to our scientists but important to the advancement of science around the world.

I have some concerns about NSF's continuing ability to support these facilities and I wonder if you can tell us a little about your plans to keep these facilities operating at their highest potential.

Mr. SURESH. Well, I appreciate your concern and it is a concern of mine as well. We have a budget line item called MREFC, major research equipment facility and construction. Currently it is about $200 million a year. The demand for that far surpasses our resources. Plus the operating costs of large facilities is quite enormous.

Just last week, I was in Chile with the President of Chile to open a major telescope facility. It is the largest telescope facility on the planet right now. It was created over 25 years. The first discussion at NSF to create the facility started in 1990. It was officially opened a week ago tomorrow in Chile.

The President of Chile, Sebastian Pinera, participated in that program. It is a $1.3 billion facility, and NSF is a lead partner in that. The European Southern Observatory, which is a consortium of European countries and Brazil, contributed an amount that matched the American contribution. Plus we had Japan and Taiwan participate from east Asia as well.

That facility has brought a lot to the American scientists. In 2011, there were two Nobel Prizes to American scientists. They did the research with NSF funding, but the research was done in the country of Chile not only with the facilities partly funded by NSF,

but facilities funded by the government of Chile, the European Southern Observatory, and east Asia. So we stand to benefit a lot.

The IRIS program that I mentioned, it involves 80 countries currently. So these programs are very important to us for our science and also for disaster mitigation.

Part of the challenge for us is that the cost of operating these facilities becomes quite substantial. Invariably because of the increasing cost of these facilities, we have to partner with other countries like Europe or east Asia to create these facilities where American scientists can work.

For example, we made a decision not to fund the super conducting super collider. Now, the facility exists in Geneva, Switzerland, and the bulk of that facility is funded by an international consortium of more than 30 countries.

Mr. SCHIFF. And that is going to destroy the whole universe, right? We drew from that, right, because we——

Mr. SURESH. No. But that is an example of a facility that we fund, the science behind this in a small way. But it leads to discovery.

So I think one of the biggest points behind your concern is that if we don't fund these facilities, can American science that needs these facilities to keep at the forefront of discoveries maintain its leadership goal? And I think this is a question that we have to address.

Mr. SCHIFF. Thank you, Mr. Chairman.

Mr. FATTAH. Mr. Chairman——

Mr. WOLF. Yes.

Mr. FATTAH [continuing]. Can I just jump in——

Mr. WOLF. Sure.

Mr. FATTAH [continuing]. For a second on this? I met with a postdoctoral student from Boston University last week who just came back from the facility in Switzerland, the CERN facility. Now, we had the world's most powerful super collider at the Fermilab right outside of Chicago. We opted out of this deal to continue and then we partnered with our European counterpart.

And I am all for partnering. But as you know, as we retreat on big science projects, what it meant was that this young man had to go to Switzerland, right, and he had to spend his time there. And there will be others like him from all over the world who because the investment in this facility took place there, they will travel there.

Some of them will end up staying there. Some of them will end up being attracted. So, you know, there are other— it is not just that the scientists can go somewhere and do their work.

Now, for instance, the observatory in Chile or the observatory in Hawaii, they are in those locations because you need the location to do the work.

Mr. SURESH. Yes.

Mr. FATTAH. But the super collider, we could have, if our Nation had decided to, we could have continued to lead in that regard. So, you know, the forfeiting global leadership in science, whether it is in super computing, whether it is in super colliding, or in these other areas, will have an impact not necessarily to the individual scientist who can travel and go and do the work that they want to

do but for our Nation's ability to do what you are pitching on the front end which is our ability to attract the greatest minds in the world. They are going to go where the science can be done at.

Mr. SURESH. Yes.

Mr. FATTAH. And they are not actually all that hung up about whether it is here, there. They want to go do their work and they will go to Switzerland and do their work or they will come here.

And the question becomes is whether our Nation wants to continue to retreat on this front because it is not that we cannot afford it. We are the wealthiest country in the world. We just have to make a decision about what our priorities are.

Mr. SURESH. Yes.

Mr. FATTAH. And if we forfeit our leadership in this area, it will, I think, create a circumstance that will be even more expensive for our country than we had invested in it.

Mr. SURESH. Absolutely. So to put the NSF budget in context, the NSF's annual budget is about $7 billion. Last year, Americans spent $7 billion on potato chips. So it puts a comparison there.

The points that you also raise go back to the comment that Dr. Harris made. It is not only that people go to Switzerland to do research. When they set up CERN as a facility, they set it up as a self-containing diplomatic enclave so that Visa requirements and all the other things are handled separately for CERN than it is if you were to visit Switzerland as a tourist or for employment elsewhere within Switzerland.

Once people go there, they not only see this banding of facilities and the opportunity to collaborate with scientists from more than 30 countries, plus you have good food and a system, an immigration system that is welcoming as well. That causes a significant competition.

And I will tell you that there are a number of American universities that have lost key faculty members to universities in Switzerland because of this attraction.

Mr. FATTAH. Well, it is not just the Swiss. I mean, Singapore is a much smaller operation, 4.8 million people. They have invested billions in their National Science Foundation. They are still—not still—they are attracting talent, American talent, you know, from—because they decided that even though they are a very small country, they want to become indispensable in certain of the life sciences and they have made the investment to do so.

And it is a very wise course and decision on their part just like it is for the Europeans. Even while they are cutting everything else in their budget, they are going to increase significantly their investment in science and innovation, right, because they understand that this is where the opportunity for economic prosperity begins and ends at. If we do not make the investments in innovation, then we get to consume what someone else has made and invented.

NSF'S RAPID RESPONSE REPORT ON YOUTH VIOLENCE

Mr. WOLF. In a few minutes, the committee will begin a discussion of the report on youth violence that the NSF recently commissioned at my request.

How was your process for commissioning this report similar or different from other rapid response initiatives NSF has undertaken?

While the report on youth violence is not an NSF product, it does contain the results of some NSF funded grants.

How active has NSF typically been in funding research on causes and responses to violence?

And for the subcommittee, right after the Newtown attack took place, which I think moved the country, I called Dr. Suresh at the NSF and said can we put together a group of people to see what is going on here.

And my own sense, and I might say that the report sort of validated what my feelings were, but it is really threefold. It is guns—and I support the Brady amendment, so we can debate the gun issue and that is going to go on—but it is also mental health. We were faced with a mental health issue in the Virginia Tech atrocity that took place, and a couple of the victims were from my congressional district.

And then also there is the whole issue of media violence. You cannot help but see some of the violence both from video games and from other sources, television and movies, without having an impact.

Campbell Soup buys ads to move people a certain way. And I can recall the movie ET. I read after they had, I think it was, Reeses Pieces or whatever it was, the sales soared simply because of seeing it on the screen.

I know it is a controversial issue and people do not want to deal with it. And this is the political process with lobbyists hired all over town to do different things. But I just felt it should be looked at.

So if you would kind of briefly describe how the members were chosen and then how active NSF has typically been in funding research on causes and responses to violence. And after you finish, we are going to bring up Dr. Bushman and swear him in.

Mr. SURESH. Thank you, Mr. Chairman. First of all, thank you for giving us the opportunity to do this. You and I spoke just before Christmas and you asked about what NSF can do to provide input.

Our Social, Behavioral, & Economic science directorate for the past 60 years has supported 60 awards in different areas of research that have an impact on youth violence broadly.

And Dr. Bushman is much more of an expert than I am, so he will have an opportunity to talk from an expert's viewpoint.

One of the things we did with respect to the process: I received a call from your office that you and I were going to speak about an hour later. And within that hour, I had access to at least 12 awards that we had given that I described during our telephone conversation.

Our colleagues in the SBE directorate quickly assembled a group of leading experts in this field to come to NSF on February 1st and February 2nd to provide an expert viewpoint.

As you saw in the report that we delivered to you, in fact, for the benefit of the other members, this is the report we gave the gentlemen——

Mr. WOLF. For the record, I sent that copy to every Member of the House, Senate, and every governor.

Mr. SURESH. And thank you for that.

I would make one point here. In fact, as the need for social, behavioral, and economic sciences constantly is being questioned, this is one of the reasons why we need SBE sciences because we have an opportunity to quickly respond to requests such as yours with a group of experts and bringing in NSF's convening power.

This group met over the course of Friday and Saturday and I had asked them to come up with the report right away so that I could deliver it to you the following week, which I did when we met to discuss this. I appreciate your disseminating it very broadly.

There are 60 awards over the last 60 years and I will quickly give you just a couple of very brief names of the kinds of projects.

The influences of TV and media on very young children, school rights, law and dynamics of every-day school life, campus violence, exploiting the communities for strategy, economic nervous system activity at the age aggregation as seen by social controlling interactions for delinquency and crime, the effect of self control on antisocial and pro-social behavior, hormonal and behavioral responses to social effect, day-to-day coping with fear, diversity of friends, bystanders, and responders.

These are sorts of examples of the kind of activity, but Dr. Bushman will be much more able to articulate the point of view than I can.

Mr. WOLF. Thank you, Doctor. And, again, we thank you for your service to the country.

Mr. SURESH. Thank you very much. And I very much enjoyed working with this committee.

Mr. WOLF. Thank you, and God bless you.

We would like to call up Dr. Bushman.

Doctor, please raise your right hand.

[Witness sworn.]

Mr. WOLF. Let the record reflect that the witness answered in the affirmative. Your written statement has been made a part of the record. You may proceed how you see appropriate. I guess I am not speaking for the committee now. I am only speaking or myself.

I was of the opinion that it is a combination of the issue of guns, the issue of mental health, having lived through the Virginia Tech, and also the issue of media violence.

And you know, Simon and Garfunkel sang a song in Central Park called The Boxer, and in it it says, "A man hears what he wants to hear and disregards the rest." My sense is that Congress and the Administration are going to disregard this.

But I am not going to disregard it. Other members have got to make their own sense, but some of the children who were killed in Newtown were the same age as my grandkids. That didn't move the nation, and my sense is, depending on where people sit politically, they kind of want to look only at a certain aspect of the problem.

We are not saying that every person that watches a video game will become violent, but the concern is when you get a person who is isolated, has mental health problems, and then you add into this, we see some very serious problems.

So with that, let me just turn it over to you. You are a Professor of Communications and Psychology at Ohio State University. You might just give us a sentence or two about your credentials, and then summarize your report and then there will be questions.

OPENING REMARKS OF DR. BUSHMAN

Dr. BUSHMAN. Sure. Thank you.

Chairman Wolf and Ranking Member Fattah and distinguished members of the subcommittee, my name is Brad J. Bushman. I am a Professor of Communication and Psychology at the Ohio State University. In the summer I am a professor at the Vrije University in Amsterdam in the Netherlands.

I have been doing research on the causes of aggressive and violent behavior for almost 30 years. I have published over 130 peer-reviewed journal articles on the topic and conducted over 50 studies on violent media effects.

In the wake of the Newtown shooting, Chairman Wolf asked the National Science Foundation and myself to find out what researchers know and don't know about youth violence and that is when they approached Katherine Newman, who is the Dean at Johns Hopkins and an expert in rampage shootings, and myself to assemble a committee of relevant expertise to address this very important topic.

The twelve of us gathered at NSF headquarters on February 1st and 2nd and to write a report called "Youth Violence: What we need to know." And so my purpose today is to summarize the results of this report.

First, I should tell you we know about youth violence. For decades social scientists have been studying youth violence and much of this research has been conducted by Federal agencies. There are also numerous and well-validated theories to explain youth violence.

When rampage shootings occur, like the one in Utah, people want to know what "the" cause is. However, there is no simple cause. Legislatures and mass media have focused on three possible causes—guns, mental health, and violence in the media, but there are many more causes besides three.

What I would like to do is just briefly describe some of those major risk factors. One is media violence. Public debate on the link between violence in the media and violence behavior can be contentious, especially following a shooting rampage.

For example, violent video games have been implicated in the Newtown shooting. We haven't proven that violent video games directly cause violence because it can't be proven. There is no way to ethically run experiments to see if playing a violent game like Call of Duty pushes somebody to violence. You can't give people guns and knives in our laboratory experiments.

But that doesn't mean we are left without evidence. We know that violent video games are correlated with violent behavior just like smoking is correlated with lung cancer. We also can't randomly assign people to smoke or not smoke and see if they get lung cancer. It is not ethical to do so.

But we do know that there are causal effects from violent media and again from violent video games as well. The most comprehen-

sive review on video games to date was conducted by my colleagues and I. It includes 381 effects from studies involving over 130,000 participants, and these studies show that violent video games increase aggressive thoughts. They increase angry feelings. They increase physiological arousal such as heart rate and blood pressure. They increase aggressive behavior. They decrease healthy behavior, and they decrease feelings of empathy and compassion for others.

The effects were observed from both males and females of all ages regardless of what country they lived in in the world, and similar effects have been found for other forms of violent media, such as TV programs, films and music.

Peer rejection and hierarchies: Most youth who engage in illegal violence have a history of social rejection, yet they want to be accepted by others. Analysis of 15 school shootings found that social rejection was a major factor in 13 of the 15 school shootings.

Youth are especially susceptible to peer rejection. They also care a great deal about peer hierarchies. Research shows that school climates and cultures and social trust can act as protective factors against youth violence.

Comparative criminology: Rampage shootings in schools differ in dramatic ways from street violence in urban areas. Violent crime mainly occurs among young people, adolescents and young adults. Poor self-control is the single best predictor of criminal behavior, including violent criminal behavior.

Many rampage shooters commit suicide following their acts. Facing their behavior is a very highly unusual category of murder/suicide.

The news media cover rampage shootings heavily, but we know very little about the effects of such coverage. Some youth may actually commit violent rampages to gain fame.

Family influences: There is a large body of research suggesting that many family-based qualities and processes are important risk or protective factors for youth violence. Risk factors include low social status, poverty, harsh or rejecting parents, chaotic family life, inter-parental conflicts, domestic violence, child abuse and neglect, family stress, poor monitoring by parents, criminal behavior or incarceration of parents, mental illness in parents.

Protective factors include close attachment bonds with consistent care givers, effective parenting, good cognitive skills or education in parents, and families that are organized, safe, and well regulated.

Data mining: Online data sources such as Twitter have multiple potential uses for understanding, predicting and preventing violence.

Guns: All shooting rampages and more than 80 percent of homicides involving youths are committed with guns. It is critical to reduce access to guns in youth, especially youth that have a history of delinquency, crime involvement and certain mental illnesses.

In conclusion, it is estimated that gun violence costs this country roughly $174 billion a year. Beyond this enormous financial cost is the devastating emotional impact of lost lives, neighborhood destabilization and fear of attack.

For children in particular, exposure to violence erodes their confidence in society. These costs alone justify the dedication of the

Federal research agencies and the scientific community to understand youth violence.

Thank you for allowing me to appear here today. The NSF advisory group that I am here to represent hopes that you will find our report helpful and I am happy to answer any questions you have.

[The information follows:]

Testimony of Brad J. Bushman, Ph.D.
Before the House Subcommittee on Commerce, Justice, Science and Related Agencies
19 March 2013

Chairman Wolf, Ranking Member Fattah, and distinguished Members of the Subcommittee, my name is Brad J. Bushman. I am a professor of communication, a professor of psychology, and the endowed chair of mass communication at The Ohio State University. In the summer, I am a professor of communication science at the Vrije Universiteit (Free University), Amsterdam, the Netherlands. I have been doing research on the causes of aggressive and violent behavior for almost 30 years. I have published over 130 articles in peer-reviewed journals, including in the top scientific journals such as *Science* and *Nature*. I have conducted over 50 studies on violent media effects.

In the wake of the Newtown shooting, Chairman Wolf asked the National Science Foundation (NSF) to find out what researchers know and don't know about the connection between exposure to media violence and youth violence, and other factors that contribute to these devastating events. NSF approached Katherine Newman, Dean of the Arts and Sciences at Johns Hopkins and an expert in rampage shootings, and I to assemble a committee* with relevant expertise (e.g., communication, law, sociology, computer science, adolescent development, natural language analysis, gun policy, data analysis) to address this urgent and important topic. The committee gathered at NSF headquarters on February 1st and 2nd to write a report titled *Youth violence: What we need to know*. My purpose today is to summarize the results from that report.

When rampage shootings occur, people want to identify "the" cause of such tragedies. However, there is no single cause. Legislators and the mass media have focused on three risk factors—guns, violent media, and mental illness. Of course there would be no school shootings without guns. The same day as the Newtown shootings, a man attacked several primary school children with a knife in China, wounding 22 of them.[1] Fortunately, none of these children died, perhaps because they were stabbed with a knife rather than shot with a gun. Guns, especially automatic or semi-automatic guns with magazines that hold a large number of bullets, allow the perpetrator to kill a greater number of victims in a shorter amount of time. Guns also provide psychological distance between the perpetrator and victim, which makes killing easier. But focusing on guns

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alone will not solve the problem of youth violence. Even a three-pronged approach, with a focus on guns, mental health, and violent media, is insufficient. Violent behavior is very complex and is determined by numerous factors, often acting together.

Before discussing risk and protective factors for youth violence, it is important to note that rampage shootings in schools differ in dramatic ways from "street violence" in urban areas. School rampages typically occur in stable, close knit, low-crime, small towns. The shooter often is a white adolescent male, with no recorded history of disciplinary problems, and no documented history of medical treatment for mental disorders. The shooter is often at the high end of the intelligence and academic achievement spectrum, but lacking in attributes highly valued by peers (e.g., athletic ability, social skills, physical attractiveness, popularity). In contrast, street violence often occurs in densely populated areas plagued by high levels of crime, low levels of social trust, and illicit drug and gun markets. Although rampage shootings like the tragedy in Newtown are rare, they are devastating because they often includes random victims. Urban bloodshed, which often unfolds between known antagonists, is far more ubiquitous and hence exacts a terrible toll on families and communities destabilized by persistent violence.

We already know a great deal about youth violence. For decades social scientists have conducted research on this youth violence, including research supported by the National Science Foundation, the National Institutes of Health, the National Research Council, the Centers for Disease Control, and other federal agencies. Numerous excellent and well-validated theories have been proposed to explain the causes of youth violence. In my opinion, such research is an excellent use of tax payer money.

EXPOSURE TO MEDIA VIOLENCE

Public debate on the link between violent media and aggressive and violent behavior can be contentious, especially following a shooting rampage. Anders Breivik, who killed 77 people in Norway, said he used the violent video game *Modern Warfare 2* as a military simulator to sharpen his shooting skills.[2] Eric Harris and Dylan Klebold, who killed 13 fellow students in Colorado, said they used the violent video game "Doom" to practice their shooting rampage.[3] Violent video games have also been implicated in other school shootings (e.g., Bethel, Alaska; Paducah, Kentucky; Jonesboro, Arkansas, Newtown, Connecticut). However, it is not possible to know whether playing violent games *caused* Breivik, Harris, Klebold (or any other killer) to shoot their victims.

We haven't "proven" that violent video games directly cause violence because it can't be proven. There is no way to ethically run experiments that see if playing a violent game like *Call of Duty* can push a person into violence. But that doesn't mean we are left without evidence. We know that video game violence is correlated with violence[4, 5] – just like smoking is correlated with lung cancer. However, this does not mean that the research does not indicate causal effects; in fact it does. The most comprehensive review of violent video game effects to date included 381 effects from 136 research reports involving over 130,000 participants from around the world.[6] These studies show that violent video games increase aggressive thoughts, angry feelings, physiological arousal (e.g., heart rate, blood pressure), and aggressive behavior. Violent games also decrease helping behavior and feelings of empathy for others. The effects were observed for males and females of all ages, regardless of what country they lived in.

Similar effects have been found for other forms of violent media (e.g. TV programs, films, music).[7]

People who consume a lot violent media come to view the world as a hostile place,[8] where violence is "normal" behavior.[9] When people expect others to behave aggressively, they are more likely to behave aggressively themselves.[10]

Aggressive youth often consume violent media because it allows them to justify their own behavior as being normal.[11] A child's own aggressive behaviors usually elicit guilt, but this guilt is relieved if the child who has behaved aggressively consumes violent media. The reduction in guilt that consuming violence provides makes continued aggressive and violent behavior by that child even more likely.

There is also a downward spiral[12] between aggression, rejection, and violent media consumption. Aggressive youth tend to be rejected by prosocial peers,[13] and therefore spend more time consuming media and associating with other rejected, aggressive youth, which, in turn makes them even more aggressive.

It is useful to consider a child's life as filled with a succession of social challenges that must be met. Indeed, many young rampage shooters are depressed and suicidal. To meet these challenges, the child draws on a set of programs (called *scripts*). In theater, scripts tell actors what to do and say. In memory, scripts define situations and guide behavior: The person first selects a script for the situation, assumes a role in the script, and behaves according to the script. Children learn scripts by observing others, including mass media characters. In many shooting sprees, the perpetrator puts on a uniform (e.g., hockey mask, trench coat, movie costume, military uniform), as if following a script from a movie or video game. This allows the perpetrator to identify more closely with other killers. The perpetrator then collects a bunch of guns, and ammunition, most often from relatives, goes to a place where there are a lot of people gathered, kills as many people as possible, and then often kills himself. For most people, carrying out such a script would be impossible. But it is possible for some who perceive the act as a means of realizing a more satisfying identity as an anti-hero or a notorious and hyper-masculine figure, lionized in popular culture and admired by peers. In this way, those who feel marginal and socially inadequate in real life achieve a sense of accomplishment through these tragic acts: they leave a mark on the world.

Parents are key in reducing children's exposure to media violence, but they need help. Media literacy programs, such as *Media Power Youth*[14], may help children become more intelligent media consumers. A universal rating system on all media (TV, films, video games), with universal symbols that are easy for parents to understand, may also help parents. The PEGI (Pan European Game Information) system, for example, has 5 age-based ratings (3+, 7+, 12+, 16+, 18+) and 6 well-recognized symbols for potentially objectionable material (violence, sex, drugs, discrimination, fear, gambling). The current rating system in the United State is like alphabet soup (e.g., R for movies; TV-MA for television, AO for video games), which is confusing to parents.[15] Violence is especially likely to be condoned in media, with films rated as acceptable for children under age 13 (i.e., PG-13) having as much violence as those rated R.[16] A warning label on violent video games might also help parents.[17] In 1972 the U.S. Surgeon General issued a

warning regarding violent TV programs: "It is clear to me that the causal relationship between televised violence and antisocial behavior is sufficient to warrant appropriate and immediate remedial action...There comes a time when the data are sufficient to justify action. That time has come."[18] Unfortunately, one unintended side effect of warning labels is that they make violent media "forbidden fruits" for children.[19] Educating parents about the research on violent video games is also important. This is an uphill battle, because the news media, entertainment industries, and other mass media purveyors may be reluctant to report that that they are marketing products that can be harmful to children.[20,21]

Although researchers have learned a great deal about violent media effects, additional research is still needed to address new and important questions, particularly given the rapid evolution of the technology. Little is known, for example, about the impact of social media on youth violence. Technology also is flooding young consumers with ever more realistic depictions of violent behavior on screen. Future research is needed to investigate:

- What types of youth are most susceptible to violent media effects (e.g., those with certain mental illnesses).
- What kinds of relationships do youth form with onscreen characters?
- When does fantasy behavior transfer to enacted violent criminal behavior among youth?
- What is the impact of immersive technology (e.g., 3D, large screens) on aggression?
- How does competition and collaboration between game players influence aggression?
- How do consumption patterns of violent media vary by geography (rural/suburban/urban), socioeconomic status (SES), gender, ethnicity, or household composition?
- Do video games tap into biological reward systems, and are they addictive in ways comparable to drugs, alcohol, or gambling?
- What role does self-control play in the use of video games?
- How do violent media impact brain development and function?

PEER REJECTION AND HIERARCHIES

Most youth who engage in lethal violence have a history of social rejection, but are highly concerned about acceptance. An analysis of 15 school shooters found that social rejection (e.g., from a romantic partner, peers) was present in 13 of 15 cases.[22] Two factors make adolescents particularly sensitive to rejection and likely to overreact in aggressive ways. First, adolescence is a time when identities are being formed and consolidated. Thus, adolescents are particularly vulnerable to identity threat and may be particularly attuned to the reactions of peers. Second, adolescence is a time of considerable biological change. Functional imaging research has found that some adolescents show both heightened reactivity in the amygdala (implicated in threat response) and lower activity in the prefrontal cortex (implicated in self-regulation) relative to either adults or younger children.[23] One feature of individuals who are highly sensitive to rejection is that when in a state of physiological threat, they perceive the danger posed by the threat source as exaggerated.[24] When guns are on hand they may be used because they may be perceived as eliminating a potentially lethal sense of psychological threat to the self.

Youth also care a great deal about peer hierarchies. In schools, self-perceived low positions in popularity hierarchies are linked to heightened stress in male adolescents.[25] High-achieving students can be stigmatized by peers as "nerds" or "geeks."[26] How peers deal with such stress varies a great deal across interpersonal and school contexts.

Research shows that school climates and cultures of social trust can act as protective factors against violence and conflict. Some schools are better at establishing and sustaining these healthy environments than others. The same school may take a turn for the better on this score, or become significantly less supportive of healthy social relations among adolescents and between kids and adults.[27] The "natural history" of adult/youth relations needs to be better understood in these key contexts because they are central to conflict resolution and better peer relations, and to building the trust needed for young people to come forward when they hear threats about violent intentions from their peers. Future research should investigate:

- How does heightened sensitivity to rejection develop among youth? How does violence serve the goals of those youth who use or plan to use it in response to rejection? Does violence provide a sense of escape from feelings of powerlessness?
- How does self-regulation capacity moderate reactions to rejection and promote more adaptive responses to social threat?
- How do security and exclusionary disciplinary regimes affect social trust and adult-youth interaction, particularly with respect to peer hierarchies and youth conflict?
- How do off-campus, third-parties (e.g., alumni, community members) facilitate or inhibit the production of social trust in schools?
- How do youth seek out help and support from adults when dealing with troubling situations, either in face-to-face or online situations?
- Among marginalized youth, what kinds of relationships might reduce risk of extreme reactions to rejection, promote help seeking and, interrupt plans for revenge that might involve lethal violence? How do youth learn to seek help?
- How do youth handle peer conflict across different contexts? What social and institutional conditions (strong and weak relational ties) facilitate non-violent as compared to violent responses?
- A number of rampage shooters have been college students or dropouts. Understanding what contributes to risk of lethal violence among college age students is important because they have aged out of adolescent peer groups and may be even more difficult to identify as a result.

COMPARATIVE CRIMINOLOGY

There is a characteristic distribution of violent behavior over the life-course, such that incidents of violence increase in frequency with age up to late adolescence or early adulthood and then rapidly and continuously decline throughout life. Violent crime, like most problem behaviors, occurs disproportionately during adolescent and young adult years. Individual differences in self-control or self-regulation are among the strongest and most consistently shown individual correlates of crime, delinquency, violence and other problem behaviors.[28]

Many rampage shooters commit suicide following their acts, placing their behavior into

the highly unusual category of murder-suicide[29]. Although murder-suicides are rare[30], they are disproportionately likely to involve multiple homicide victims[31]. It is likely that suicidal youth who consider killing others as well as themselves have hostile attitudes toward others, perhaps blaming them for their condition.

The news media cover rampage shootings heavily, but very little is known about the effects of such coverage. Does such coverage increase thoughts of imitation, as it does in suicide? Is it more likely to influence thoughts of imitation among youth who already have thoughts of suicide and homicide? Do some youth use such events as ways to achieve notoriety, as has been suggested in sensational coverage of suicides?

More research is required to discover the similarities and differences between rampage shootings and more common forms of violent crimes and delinquencies (e.g., the extent of planning, the relationship between levels of self-control or self-regulation and violence, the solitary or group nature of the offending, and the time, place, and method of occurrence). Future research should investigate:
• The relationship between suicide and homicide, and the intersection between the two, especially in regard to ideation for committing both acts.
• Whether there are differential effects of self-control or self-regulation for the development of suicidal and homicidal ideation.
• How school and other social institutions can create enhanced social efficacy and bonding effects for students, and how differences in school climate can reduce levels of crime and violence particularly during adolescence.

FAMILY INFLUENCES ON VIOLENT BEHAVIOR

There is a large body of research suggesting that many family-based qualities and processes are important risk or protective factors for antisocial behavior, including youth violence.[32, 33, 34, 35] Risk factors based in the family include low social status, poverty, harsh and rejecting parents, chaotic family life, inter-parental conflict, domestic violence, child abuse and neglect, family stress (prenatal and post-natal exposure), poor monitoring by parents, criminal behavior or incarceration of parents, and mental illness in parents. Protective factors based in the family include close attachment bonds with consistent caregivers, effective parenting, good cognitive skills or education in parents, and families that are organized, safe, and well-regulated.

Yet there are many gaps in knowledge about the roles of families in violent behavior that could inform policy and interventions to reduce risks for youth violence and promote resilience among high-risk youth. Important data could be gathered from large child longitudinal development data sets and planned studies, such as the National Children's Study. Future research should investigate these questions:
• How do early experiences, toxins, and stress in the family, both prenatal and post-natal, alter child development to increase vulnerabilities or risks for later violence?
• What are the most cost-effective protective interventions for families in different phases of child development to reduce risks for later violence?
• Do family-focused interventions that improve self-control skills in children reduce youth violence? What interventions and timing are the most beneficial and cost-effective?

• What are the most effective interventions and timing for educating parents about effective and age-appropriate ways to monitor child behavior, including their media use, peer interactions, and school involvement?
• Given that high-risk families (e.g., unstable, impoverished or poorly educated, with incarcerated parents, substance abuse, or violence in the home) contribute disproportionately to violence in inner-city neighborhoods, what are the most effective and timely interventions to prevent intergenerational transmission of these problems in families? • Do some systems intended to help children, such as foster care, juvenile justice, or special education systems, unintentionally increase their vulnerability for exposure to violence and risks for developing violent behavior?
• What kind of mental health and community resources are needed for families concerned about a child who demonstrates signs of preoccupation with violence, violent media, or violent behavior?
• Do large-scale interventions underway that aim to increase academic achievement (e.g., Race to the Top or Promise Neighborhoods) also mitigate youth violence?

DATA MINING FOR PREDICTION AND INTERDICTION OF SHOOTINGS

Online data sources may have multiple potential uses for understanding, predicting, and preventing violence, such as: (a) tracking population-level demographic and geographic trends in risk behaviors, (b) geographic "hot spot" prediction for urban violence, (c) "risk stratification" to identify—with appropriate safeguards—those who are signaling violent intentions and who would benefit from early intervention, (d) facilitating the reporting of planned or potential attacks by others (e.g. friends and classmates) with knowledge of impending events, and (e) understanding "bullying" behavior and its role in influencing violence. Each of these potential applications should be explored further to analyze its potential impacts (benefits and risks) and feasibility of implementation. Many of the methodological tools needed for these analyses (such as anomalous pattern detection, predictive modeling, sentiment analysis, and social network analysis) have already been developed in the fields of machine learning, data mining, computational linguistics and statistics. Research in any of these domains must address the potential biases and limitations of these online data sources, as well as mitigate serious risks to privacy.

The focus should be on developing tools that can be broadly used, and framing methodological questions (e.g., early event detection and prediction) that generalize across multiple domains. The solutions to such problems would then advance the science (e.g., of language understanding, massive data analysis, and pattern discovery), as well as potentially preventing or reducing youth violence. Future research should investigate:
• Can Twitter and other online data sources (e.g., gaming forums) be used to track the demographic and geographic trends in consumption of violent media and correlate these with other indicators (e.g., use of violent language), accounting for demographic and other biases in these data sources?
• Can new data sources (e.g., Twitter, or specialized systems to monitor, identify, and track graffiti) be integrated with currently used law enforcement and 911 call data to enhance the timeliness and accuracy of prediction ("where" and "when" street shootings are likely to occur, as well as predicting "who" may be the perpetrators and victims).

• Can we identify "risk factors" for individual mass shooters that are both predictive, and can be reliably extracted from online data, such as latent user attributes (location, age, gender), socioeconomics (poverty), family (divorce, single parents), access to guns, expressions of violent sentiments, intentions, and plans, signs of certain mental illnesses, attitudes toward violence, social relationships (marginality, social rejection, encouragement by peer groups), etc.? Can administrative data be integrated with online data for more accurate risk predictions?
• Can we accurately model both the probability that these risk factors are present given noisy, unstructured online data, and estimate overall risk of violence given these factors?
• Is there a role for monitoring of online data in early warning and rapid response to mass shootings, similar to its role in disaster response more generally, to inform law enforcement and potential victims?
• Can we understand and develop a framework to inform and encourage best practices of online interventions at various stages leading up to a potential mass shooting (teachers providing online, positive influences; availability of mental health counseling; mitigating negative impacts of social rejection; facilitating reporting of potential threats and at-risk individuals in need of help)?
• Can online data from occurrences of "cyber-bullying" be captured and analyzed to understand the causes, processes, and impacts of bullying behavior more generally? What are the similarities and differences between online and offline bullying behavior (e.g., online anonymity and greater spread of embarrassing information), and how do these change the impacts on victims of bullying?
• What are the risks of mining online data to individual privacy, and how can these risks be mitigated or eliminated? For example, when are aggregated counts and de-identified data sufficient to study violent behavior? On the other hand, under what conditions is it acceptable to use online data to intervene at the individual level (which may not be possible without identifying at-risk individuals)?

GUN POLICY AND YOUTH

All mass killing and more than 80% of homicides involving youth are committed with guns. It is critical to reduce access to guns in youth, especially those with a history of delinquency, crime involvement, and certain mental illnesses. Future research topics:
• What is the relationship between minimum age or youth-focused firearm restrictions (e.g., safe storage) and youth-perpetrated violence? Is the effectiveness of these laws dependent upon other gun regulations designed to deter the diversion of guns to prohibited persons (e.g., universal background checks, licensing provisions)?
• How do penalties and illegal gun suppression tactics by police affect illegal gun carrying and use by youth?
• How do factors such as price, trust in gun sellers, gun characteristics (new/used), and perceived risks of prosecution affect youth illegal acquisition of firearms? How easily do youth adapt to interdiction strategies (e.g., access sources outside of state if state gun laws reduce gun diversions)?
• Do youth steal guns opportunistically or target homes, stores, or individuals for gun theft? How important are stolen guns to the underground gun market where youth acquire guns? How commonly do youth discard guns, lose them to theft, sell them, have them confiscated by parents, police, or school authorities?
• How do youth access ammunition?

• How much do community members know about how youth are illegally acquiring guns, stashing, and carrying guns, and are they willing to share this information (anonymously) with police?
• When do youth share guns?
• Can mediators (e.g., street outreach workers, peers) keep guns away from youth planning rampage shootings?
• What is the potential for new technologies (personalized guns) to reduce youth violence? How will consumers react to the introduction of these new technologies?

CONCLUSION

It is estimated that the social cost of gun violence is roughly $174 billion a year.[36] The costs include medical and mental health care costs, criminal justice costs, wage losses, and the value of pain, suffering and lost quality of life. Beyond this enormous financial toll, is the devastating emotional impact of lost lives, neighborhood destabilization, and fear of attack. For children in particular, exposure to violence erodes confidence in social institutions and the society they live in. These costs alone justify the dedication of our federal research agencies and the scientific community to understanding the problem of youth violence.

Thank you all for allowing me to appear before you today. The National Science Foundation advisory group that I am here to represent hopes that you will find their research and their suggestions for future research that could help the country understand and prevent gun violence, useful and practically valuable. I am happy to answer any questions you might have.

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http://www.childrenssafetynetwork.org/cost-gun-violence

Mr. WOLF. Thank you.
Mr. Fattah.
Mr. FATTAH. Thank you, Mr. Chairman.

RAMPAGE SHOOTINGS VS. MORE GENERAL VIOLENCE IN SOCIETY

You know, since, I guess, Cain and Abel, you know, violence has been among us, and there is no society in the world in which violence is not part of, you know, the society.

Our situation here in America seems to be somewhat different inasmuch as we seem to have an over-amplification of violence, particularly with guns. There is no other place on earth even where, you know, where there are prevalence of guns available where they are used in such as a way as they are here.

But you know, we had a situation yesterday at a university in Florida where a young man killed himself after it was discovered that he was planning some sort of attack with both guns and explosives and a lot of these situations seem to fall into a certain category, these, what you I think refer to as rampage shootings like that.

They are in the kind-of everydayness of this. You know, there have been over 2,000 people killed since Newtown, most of them not with an AR–15, not with the publicity associated with the shooting of a group of young people, but just, you know, every single day in our country these seems to go on.

And it is a real challenge. The chairman is right that there are obviously multiple factors to this. NIH has been doing a very significant study with the largest group of adolescents ever, some 10,000, looking at their development over a period of time through brain imaging. And it seems as though, you know, this social isolation is a very, very important factor in some of these activities.

You know, when I grew up, you know, we saw a lot of violence in the movies, you know, westerns with John Wayne, and then we had, you know, we had a lot of the movies that glorified the mafia, you know, like The Godfather, one of my favorite movies. And you know, we had a whole series of Die Hard and other kinds of movies.

You know, in my city is where they frame this Constitution and the Bill of Rights where they gave out certain rights, the right to free speech. And you know, there is some regulation of it, but it is a very important fundamental underpinning of our society and, you know, so you know, we started talking about what we do, people say, well, you know, obviously people who make video games can, you know, under freedom of speech they can do anything they want. And it is true, I mean.

But you know, it is also important for us to understand the impact of these things. Now, there is not a direct causal, as you said, relationship between, you know, kids might watch it, they are not going to go out and shoot up their school. But if the kid has some other issues, some problems, socially isolated, is prone to violence, has some other, you know, they could be a triggering, I guess, or even a training event.

So but I think that, you know, we have to look at not just how we deal with rampages, but how we deal with this general pervasive nature of utilization of violence as a way to solve conflicts in

our society, and I am not sure that we are going to be able to regulate that from the United States Congress. We can do something about people's access to guns or ammunition but that is even limited because, you know, if you limit, you know, certain types of guns—I mean, even in the most aggressive proposal by Senator Feinstein, you know, it exempts 2,000 guns; 2,027 are exempted from even the notion that we would ban them.

So there are going to be guns in our society. The question is how we get people to think about how they solve problems without killing each other, and particularly for young people who are if they are socially isolated or if they have some type of psychosis or some other issue, how do we from society figure out how to provide help in situations where usually the person is not even known other than to their family and most young people who are, you know, who have some, you know, if it is a schizophrenic situation, they are some of the least likely, you know, but there is a small percentage of people who, for whatever reason, and some of it may be media attention, you know, because people look at Columbine and then they looked at some of these repeat instances on the same date as the Columbine massacre. You know, obviously, people were, they were engaged in some pattern of activity connected to that.

But you know, the rampages are just one small part of this gun violence issue. I mean, a lot of people are being shot down every day and not in large numbers, not as hard as some rampaged. That has to be a concern also.

So I will be glad to hear any response to that.

Dr. BUSHMAN. Yeah, you are correct. There is a big difference between school rampages and street violence. We talked about those in our report. School rampages often occur in small, low crime towns. The shooter has no record of delinquency problems. The shooter has no record of treatment for mental disorders. The shooter is not only smart. The shooter generally has good grades, but the shooter generally lacks attributes that are valued by peers, and they are not at the top of the peer hierarchy.

In contrast, street violence occurs in densely populated areas plagued by high levels of crime, low levels of social trust, illicit drug use and gun markets.

Often, the differences in shooting rampages, they do involve social rejection and usually the killer kills whoever rejected him. It is almost always a male. The rampage shooters are almost always males.

I am sorry.

Mr. WOLF. That is all right. Go ahead. Continue.

Dr. BUSHMAN. They almost always are males and the shooter usually kills whoever rejected him—it can be a girlfriend, parents, peers—and then kills as many other people as possible before killing himself. Suicide is very common in these shooting rampages. The shooter often gets the guns from relatives.

So there are very important differences between the shooting rampages and urban violence that you talked about.

Mr. FATTAH. Thank you, Mr. Chairman.

Mr. Culberson.

RELIGION AS A PROTECTIVE FACTOR AGAINST VIOLENCE

Mr. CULBERSON. Thank you very much for the work that you have done. I recall years ago when the shooting occurred in Colorado. There was a hearing on gun control and one of the parents appeared and said that in his opinion one of the biggest problems in his mind was the removal or the absence of any spiritual foundation that all these kids had. They had no spiritual foundation at home, whatever their religion may be. If they had an absence of a sort of a set moral guidelines based on a belief in God or a higher being, whether that be the Ten Commandments or whatever it is at home. Once the human heart was empty, what do they expect to fill it up with all this poison out there around us.

I have gone through this from top to bottom. I don't see any study, any mention, any analysis of any kind of the effect of the absence or presence of the Ten Commandments or a spiritual belief in the home on these kids, on youth violence.

Have you looked at it?

Dr. BUSHMAN. That is because there is hardly any research on that topic at all. There is some research. My colleague, Ralph Huesmann, at the University of Michigan has found that a religious foundation is related to less aggression and violence in youth, but very few studies have looked at that, although they should.

Mr. CULBERSON. That is very revealing in and of itself. I think it is astonishing because I grew up with guns in a house and it is just not a problem. I mean, you have got a good strong moral and religious foundation in the family and, you know, healthy mom and dad, or healthy families is obviously critical of that, but the presence of a strong religious faith and moral grounding is, I think, fundamental to a healthy society and it is certainly reflected in, I think, in the—you just said there was one study that showed that it was a strong religious or moral foundation in the home and you typically didn't have a problem with violence. Great.

Dr. BUSHMAN. That is just kind of a protective factor, yes, which is common. There are many protective factors and many risk factors, and that is certainly one of them.

Mr. CULBERSON. Well, that has got to be a powerful one, though. I was taught all my life you don't touch a gun and we grew up in a family. It has just not never been a problem.

In any event, we appreciate the work that you are doing and the studies, but I personally, common sense, personal experience, the fine knowledge of Texas, we all have come from different surroundings, but the solution to this doesn't seem to be very complicated. It is just strengthening the family, strengthening giving, doing everything we can as a society to encourage strong families with a mother and a father and stop trying to drive religion or spirituality out of every public institution.

Congress can't make any law respecting an establishment of religion. It wasn't what the founders intended. In fact, they actually held church services in the Rotunda for much of the 19th century.

Thomas Jefferson, my hero actually, signed an executive order opening up the Rotunda of the Capitol for church services in Washington, DC. The intent was to prevent the creation of an Anglican church, for example, in the United States. It wasn't to drive the

Ten Commandments out of every public institution, to drive prayer out of public schools. I think that has probably been as destructive as anything else.

Unfortunately, unavoidably the human heart, there is a lot of eat-on poison out there, but if you have got a strong moral foundation on which to stand, on a rock instead of sand, you can resist that.

Dr. BUSHMAN. I should say that Professor Ann Masten, who is professor at the University of Minnesota, was part of our committee, and there is a major section of our report on parental factors, the role parents and family can have on youth violence. And it is really important. Parental factors and family factors are very important in understanding, not only risk factors for youth violence, but also protective factors.

Mr. CULBERSON. And I hope you will do what you can in your position to encourage your colleagues to do more studies in the correlation between obviously a strong family and a strong moral religious foundation in preventing and discouraging violence because it seems to me that is where the answer lies, in the human heart, not in the laws that we pass. Thank you.

Mr. WOLF. Mr. Schiff.

Mr. SCHIFF. Thank you, Mr. Chairman.

TRENDS IN VIOLENT CRIME AND VIOLENT MEDIA

First of all, I wanted to ask you a couple of things. One is, over the last decade or so there has been a fairly dramatic reduction in crime and violence on the whole, and that is reflected in the decrease in youth violence at the same time. The same time over the last decade, you know, I think the proliferation of violent video games has increased, not decreased.

How do you reconcile the conclusion of your report that violent video games could contribute to violent acts if at the same time you see an increase in the number of video games and the prevalence of violent video games, you see a significant decrease in youth violence?

Dr. BUSHMAN. Yeah, I would be happy to address that point, and it is a valid point and an interesting point. It is true that violent crime rates have been going down in this country, and it is fantastic. It is wonderful, and I hope they continue to decrease.

But that assumes that the only factor related to violent criminal behavior is media violence, which, of course, it is not. Violent criminal behavior is very complicated and determined by many factors. In terms of overall crime rates, probably the best explanation for reduced crime rates is the U.S. population is getting older and older and older.

Since the 1990s, when violent criminal behavior was the highest, if you look at the increase in age, America is getting greater and greater. Old people don't rape, rob, murder and assault people very often at all.

Also, if you look at the same period, incarceration rates have increased dramatically, and it is much harder to murder, rape, rob and assault people if you are locked up behind bars than if you are roaming the streets.

So I am not a criminologist, although we have some criminologists on our panel.

Obviously, violence is not determined solely by violence in the media. There are other factors that may explain the decrease in violent criminal behavior in America, but there is certainly a correlation between youth violence and violent media consumption, and there is a causal relationship between exposure to violent media and aggressive behavior.

CORRELATION BETWEEN MEDIA VIOLENCE AND AGGRESSIVE BEHAVIOR

Mr. SCHIFF. On that latter point and no one is suggesting that violence in the media or violence in video games is the sole determining factor of the level of crime, but I think it does indicate that there are factors that are much more significant in determining the level of violence than the level of violence in media. Otherwise, if it were the most significant factor, the vector would be pointing in the other direction. We would have seen a fairly dramatic increase in youth violence and violent crime over the last decade which we haven't seen.

But you know, I have read some commentary of your analysis that was critical in that it indicated that it did not feel that your report considered any of the countervailing data and reports, and that really relied upon only reports that led to the same conclusion, and I wonder if you could respond to that because I know there were a couple of meta studies that were done fairly recently—one in Sweden in 2012, one in Australia in 2010—that found, contrary to what you just stated, no causal relationship between violent video games and aggressive behavior.

And it also found that there were, the studies that did show a small statistical correlation had severe methodological problems, so I wonder if you considered it in your reports; if you did, why you didn't cite them or try to explain the results.

Dr. BUSHMAN. We do cite them, and the meta analysis that I described that involved 381 effects from studies involving over 130,000 participants included all those studies, all of them, up until that point. And in that meta analysis that I described, the most methodologically rigorous studies actually had the largest effects.

So maybe there have been some studies since. Ours was published in 2010. But the one we published had at least ten times as many studies as any other meta analysis ever conducted, the most comprehensive by far, and we didn't pick and choose which studies to include. We included every single study conducted on violent video games until that point.

Mr. SCHIFF. And how do you then attribute the dramatically opposite conclusion you reached from the conclusion the government in Sweden reached in its 2012 study or Australia reached in its 2012 study?

Dr. BUSHMAN. Yeah, I think it is a matter of interpretation. So we find average correlations of about .20. They find average correlations of about .20. We say they are not trivial. They say they are trivial.

Well, the average correlation between wearing a condom and getting HIV is .18, right. I would say that wearing a condom is not

a trivial factor in determining whether you get an HIV infection. The average correlation between second-hand smoke and lung cancer is less than .2. The average correlation between exposure to lead and brain functioning is less than .2. The average correlation between exposure to asbestos and cancer is less than .2

The correlation between one sexual act and getting pregnant is .16, so well, I think nobody would say sex is not related to pregnancy. I mean, who would say that?

Mr. SCHIFF. Is that the only difference between your meta analysis and these others that basically you have reached the same statistical correlation but they reach a different conclusion from it?

Dr. BUSHMAN. I think so. I think that is a major difference, how you interpret the effects. If you look at the average correlation figure, they are virtually identical to ours. They just dismissed the magnitude of correlation as trivial, and we would say it is not so trivial.

Mr. SCHIFF. Just drawing on the point from Mr. Culberson. I completely agree with Mr. Culberson. You know, I think having a religious and spiritual upbringing certainly helps in terms of raising children and the values of those children.

But on that subject you participated in, I think, a fairly controversial study in 2007 that found a link between reading violent passages in the Bible and the same kind of aggressive behavior that you are attributing to video games. Is that——

Dr. BUSHMAN. It is not a controversial study at all. It was published in Psychological Science, one of the top scientific journals in my field, and it did show that violence in the scriptures, especially when God sanctions it and says it is okay to retaliate, increases aggressive behavior in readers.

Mr. SCHIFF. Did you find that comparing the degree to which that people were inspired to act more aggressively or violently from reading violent passages in the Bible, was that a stronger effect or approximately the same effect as a violent video game?

Dr. BUSHMAN. I would have to go back and look. I can't remember the exact effect, but I assume it is—I honestly can't tell you off the top of my head.

Mr. SCHIFF. And did you reach any conclusions as a result of that study in terms of what you thought?

Dr. BUSHMAN. It follows directly from theory that exposure to violence in the media—especially when the source is credible, as God is, when it is justified, if God says it is okay to do it, then it is okay to do it. The effects follow directly from theory.

Mr. SCHIFF. You know, getting back to the violent video games, to what degree do you think we should be influenced by the example or non-example of some of the mass killers that we have seen? The mass killer in Aurora, for example, liked video games but his video game was Guitar Hero. You had others like the killer in Scandinavia who did watch violent video games to learn technique in terms of shooting people. Each case is further radically different. How much would you conclude from any particular case about the influence of video games on them, or is the common denominator more mental illness, or a combination of mental illness and exposure to violent media?

Dr. BUSHMAN. Yeah, we will never know what caused any killer to commit those acts. We will never know. And they are incredibly rare and very difficult to reenact. But we do know that playing violent video games or other forms of violent media can cause more common forms of aggressive behavior like children fighting on a playground, pushing each other down, pulling each other's hair, kicking each other, tripping each other, hitting each other, those kind of things.

But it is impossible to know what caused those. We could look at correlations and I would say the strongest correlation is pure rejection. That if you look at analysis of school shooters, I think I mentioned the 15 school shootings, peer rejection was present in 13 of the 15. So I would say if I had to choose one factor, I would say peer rejection would be the biggest factor.

There is some research showing that people who are particularly vulnerable may be more affected by violent media than those who are not. We need a lot more research on that topic.

Mr. SCHIFF. Thank you, Professor.

Mr. Chairman.

Mr. WOLF. Mr. Graves.

PREDICTING VIOLENT BEHAVIOR

Mr. GRAVES. Thank you, Mr. Chairman.

And it is fascinating in listening here. I am a father of three, wonderful wife, school teacher, three kids who are in elementary and junior high. So what occurred a few, or I guess a couple of months now ago struck me, and it hurt to watch what occurred.

But I am a gun owner, too. I teach my children to shoot, to be responsible. Hunting is a big part of our, I guess, culture in North Georgia. And I listened to this a little bit and I guess I am struggling with some of the conclusions and maybe you can help me with because—and Mr. Schiff did a great job of sort of looking at how society is changing, how violent acts have gone down while gains in media have increased, trying to see what really is that correlation.

But I remember back when I was growing up, my favorite movie on TV at that time was the Dukes of Hazard, one of the great all-time series. But I didn't grow up thinking I had to outrun the law, you know, run shine, hang out in my car with a bow and arrow, paint a number on the side of it.

My favorite all-time movie was Smokey and the Bandit. It never crossed my mind that I would ever grow up to run beer from Colorado to Georgia and circle around Atlanta Motor Speedway in celebration of that, and that was some great feat.

And so I think about these correlations, I think about all the good that is on TV, a lot of great entertainment, clearly. American Idol, probably one of the most popular TV shows on right now, but my kids aren't running around singing, nor are many others.

So I am having a real hard time connecting this because in our family, and I will go with Mr. Culberson who was talking about the family unit and how important that is, and we fail to recognize how important that is and how throughout history, even biblical history has been referenced here, evil exists and I don't know how you craft policy that will prevent evil because our job is to protect the

rights of the American people. We certainly can't prevent every evil act that is going to occur.

In fact, it seems to be that of late, Mr. Chairman, that a lot of the policies that are recommended are to punish law-abiding citizens rather than the actual criminal acts themself and some hope that even though these criminals violated so many laws to get to that evil act in which they committed, that if we punish law-abiding citizens, that might not have happened, but in fact they broke so many laws already.

Mr. Chairman, you may not be aware but in Georgia we have a city just south of my district, Kennesaw, Georgia. And in fact, in that city, and it has been on the news lately, it is a requirement that every homeowner have a firearm in their house. That's city ordinance.

One of the lowest crime rates in the United States is in the city of Kennesaw, and I imagine they watch video games and have access to the outside media as well, but yet there is responsibility there and family unit and all.

I read an editorial by a D.C. prosecutor just prior to the ban. He referenced the ban in D.C. and the results afterwards, and in fact, homicides increased after the ban on firearms in the District of Columbia and homicides decreased after the Supreme Court struck that down. Now, he even acknowledged they made a bad decision back—I guess that was in the '70s if I remember right.

So I guess my question is, in just thinking through all of that, and I know I rambled a little bit, in your opinion, I mean, if a child or youth in what you're referencing doesn't watch movies, doesn't play video games, and doesn't read the Bible, are they less likely to commit violent acts?

Dr. BUSHMAN. Yeah, well, hardly anybody commits violent acts. In fact, I think .1 percent of FBI crimes are murders. So, if the standard is well, I play violent video games and I have never killed anyone, great, nobody kills anyone. I mean, it is so rare that anybody kills anyone.

What I want to know is how you treat your parents, how you treat your siblings, what you think the world is like. Do you think it is a scary and dangerous place where you will become a victim of violence? How rude are you? How do you act in a car when you're driving down the road?

Yeah, I am a firm believer in free speech and I advocate that. But, you know, we don't let our kids drink beer and we don't let our kids smoke cigarettes, and I think it is inappropriate to let children play age inappropriate games.

Games are clearly rated, like M rated games are for players 17 and older. Yet many, many children under age 17 play such games.

I'm a father of three children, also. I don't let my kids play those games. What can we do? Well, one thing—I'm also a professor in the Netherlands, in Amsterdam, and in the Netherlands and much of Europe they have a universal rating system, for TVs——

Mr. GRAVES. Excuse me for interrupting.

Dr. BUSHMAN. Yes.

Mr. GRAVES. You may not let your children watch video games and that is your decision, I do the same—or play video games, I

am sorry. And we govern that in our home. But, do you let your children read the Bible?

Dr. BUSHMAN. Yeah, of course.

Mr. GRAVES. Okay. Because you had mentioned a minute ago that is actually your study—I guess Mr. Schiff indicated that you had produced a study that said there are passages in the Bible that incite criminal acts.

Dr. BUSHMAN. I didn't say that. I said when God sanctions killing, when God says it is okay to kill, when God says it is okay to retaliate, it increases aggressive behavior. I didn't say anything about criminal acts.

There is a huge difference between violent criminal behavior such as raping, robbing, assaulting, and murdering someone, and aggressive acts.

Mr. GRAVES. Which God says is wrong.

Dr. BUSHMAN. Right.

Mr. GRAVES. Right.

Dr. BUSHMAN. And aggressive acts, which we measure in the laboratory by doing things like having people give each other electric shocks or loud blasts of noise through headphones, or have people eat spicy hot sauce, or force somebody to stick their hand in ice cold water. That's how we measure aggression.

So, in that study the measure of aggression was giving somebody a loud blast of unpleasant noise through headphones. That's the measure of aggression that we used.

But, I would like to finish my comment that I think—you know, what can we do? You asked, what can we do without stomping down our amendment rights?

Mr. GRAVES. No, my question was, do you believe if a youth does not watch a movie, play a video game, or read the Bible, are they less likely to commit a violent act?

Dr. BUSHMAN. Yeah, I think violent acts are very rare and determined by many risk factors, and these are just a few of the many risk factors for violence.

Mr. GRAVES. Do you—and you mention media quite a bit, do you include books in that category?

Dr. BUSHMAN. There needs to be a lot more research about books. Hardly any research exists on books. There are a few studies on violent comic books, and those studies show that violent comic books at least increase aggressive thoughts. But, we need more research on books. There is not so much research on books.

And the reason I talk about violence in the media is that is what I spent the last 30 years of my life doing. But there are other members of our committee who are experts in other areas, and you can find their comments in our report.

Mr. GRAVES. Okay. Well, Mr. Chairman, I will wrap up and say that from my perspective I think this is in large part a responsibility of the family, the family unit, and particularly fathers of children. Just as you have indicated, you make choices for your family and the right way to rear them and I applaud you on that and I do the same for mine and I certainly don't want the Federal Government dictating how I must or must not do that.

Mr. WOLF. Mr. Serrano.

IMPACT OF ACCESS TO GUNS

Mr. SERRANO. Thank you, Mr. Chairman. Mr. Chairman, you and I have been around here a long time and you longer than I and, not by long, not too much longer. And this hearing really explains and indicates what a dilemma this is, because you notice that the opening statement before a question by most members, and I am going to do the same thing, is longer than the question itself. And that is because we are conflicted.

You know, I am a strong advocate for strong gun control laws. Yet, I am one who believes in freedom of speech enough to do whatever I have to do to protect it. And so I feel the need to say, 'put on the market whatever game and let the parents control it.' But I know that there is a problem with some of these games being too violent and I wish either parent or government or something could come to an agreement on how to deal with them.

But, you know, Mr. Culberson brought up a point, which—and he and I have discussed this in the past, and that is that, yes it is important and I am the first one to admit it and agree with it that there has to be a center in the family, faith-based, if you will, that tells us what and how we have to behave.

But, there is a contradiction in this country. I just told you that I am a contradiction when trying to deal with this conflict. There is a contradiction because some of the folks—and I am not referring to him—but some of the folks who speak of having a Bible in the house and so on, are the same ones who after they read the Bible, speak ill of other people around the children and then wonder why the children grow up not liking some people.

You are not going to see that more than in the next few months when we do, hopefully, immigration reform in this country. The verbal violence that you're going to hear on the radio and see on TV, verbal violence against those people, against them, against those "illegals," is really going to make some people, I think, angry. Whether they will react to it or not, angry.

I experienced some of that. Recently, two things happened to me in cyberspace on Facebook and Twitter which were very interesting. One was, that I have been putting in a bill since George Bush, the father, was President, saying that I don't believe in term limits for presidents, that I believe in people voting you out of office.

So, I have this bill to do away with presidential term limits. Because President Obama is now President somebody found out about that and said I was going to destroy the Constitution and went berserk, and what I was called and where I was told to go was pretty, pretty violent verbally.

Then, I didn't learn my lesson; when President Chavez passed away I said, "President Chavez changed the conversation of Latin America to pay more attention to the poor." Even his opposition said that is true, oh my God.

I also found out which of all the Latino groups people seem to be angriest at, because they kept telling me to get out of the country and go back to Mexico and I was born in Puerto Rico, but it shows you where people are at. And you're going to see that.

So words, as we know, do have consequences and I think a lot of the folks who say that we have to have more religion, more faith, which I agree with, you know, control this, control that, also have to be responsible for the words they use. Because those words can hurt a lot of people and cause people to hurt others.

And so, I, as I started out to say, am conflicted about just how much we do. So, let me ask you a question leading in this way. Do you think that there is a correlation between violent video games and the access to guns in this society?

Dr. BUSHMAN. That is one of the things we recommend funding for research, that we don't know but we need to know. We have some initial data that show that guns are appearing more and more in violent media as time goes on. You're more and more likely to see a gun. But we don't know that, and we recommend funding to do that kind of research to find out.

Mr. SERRANO. All right. You don't know, but do you have a sense about this? I mean, I want to know in your profession if you give out opinions without doing the research, you know.

Dr. BUSHMAN. Yeah, I am reluctant to do so.

Mr. SERRANO. Right.

Dr. BUSHMAN. I like to base my statements on data.

Mr. SERRANO. Now you, obviously, also, in all your studies come across the issue of freedom of speech and, you know, those things that we value in this country.

Dr. BUSHMAN. Right.

Mr. SERRANO. The ability to say what we wish and let others decide how to deal with it. Is it an issue of freedom of speech if we set out to control or put restrictions on the use or the sale of video games?

Dr. BUSHMAN. I think for adults, perhaps. But I think we do control what our children are exposed to, and I think for children that we have a responsibility to protect them.

Mr. SERRANO. Thank you. Mr. Chairman, I just realized something also, on those two issues, the presidential term limits and the Chavez comment, things have died down and I just brought it up, so it will probably start up again this afternoon. Thank you, Mr. Chairman.

Mr. WOLF. Dr. Harris.

RELATIONSHIP BETWEEN VIOLENT BEHAVIOR AND SUICIDE

Dr. HARRIS. Thank you very much and thank you for appearing before us and I am going to apologize. I haven't been able to read the entire—my staff, unfortunately, didn't give it to me. Your staff was nice enough to give me the summary—the youth violence.

But, let me ask you, because as I go through it, when I looked into the—and I—look, I have five children and three of them teenagers right now. When we look at violence it seems that you play down, because I looked for the word suicide in this report and I think it only appears once in the section on gun violence. Yet, we know that——

Dr. BUSHMAN. In comparative criminology.

Dr. HARRIS. Oh, does it appear there also? Okay. So—but if we look at the word shootings and we look at other words that appear much more often and yet, when you look at the statistics, as you

are well aware, between the age of 15 and 19, homicide is the second leading cause of death, suicide the third. And there have been studies to show that perhaps up to three quarters of the homicides are gang related.

So, if you set aside gang related homicides, I am pretty confident my children don't belong to a gang and I think the average person in their own household, since gangs are a very small minority of people, I think they want to say what about for non-gang related violence, suicide, in fact. If you consider the violent act against yourself—suicide is actually more common than homicide in teenagers; is that right?

Dr. BUSHMAN. Yeah, well——

Dr. HARRIS. I am just—it appears——

Dr. BUSHMAN. Most scientists would not call suicide violence.

Dr. HARRIS. And why would you not call taking your own life a violent action related to a lot of the preceding factors that you talk about here—self esteem, psychological illness? Why do we not consider that disrespect for life and the taking of it, a violent act?

Dr. BUSHMAN. I think it is just conceptually clearer to keep suicide in a separate category. It is not that scientists don't care about suicide or aren't studying suicide, but they define aggression as intentionally harming another person.

Dr. HARRIS. Then why is suicide mentioned in—I mean——

Dr. BUSHMAN. Another living person.

Dr. HARRIS. Yeah, I know. But you kind of bring it in. You kind of bring it in in two places you say, but by what you're saying now, you should academically keep them separate. You kind of want it in there——

Dr. BUSHMAN. No, we——

Dr. HARRIS. I know it is an uncomfortable topic because look, it is a real problem among teenagers.

Dr. BUSHMAN. We talk about it in connection with many rampage shooters who, after killing others, kill themselves.

Dr. HARRIS. We know, but the school related shootings are less than one——

Dr. BUSHMAN. Yeah, right——

Dr. HARRIS. Less than one—so, again, you know, I know this was all brought about by a rampage shooting incident.

Dr. BUSHMAN. Right.

Dr. HARRIS. But we would be missing an opportunity to delve into what is a real problem whispered about, worried about by parents, but not a high profile topic.

Dr. BUSHMAN. Yeah, I agree. It just wasn't a charge of our committee.

Dr. HARRIS. Well—and is that because you don't consider—I mean, 40 percent of suicide deaths are firearm related, so it is not an insignificant number.

Dr. BUSHMAN. Right.

Dr. HARRIS. So, under youth violence—so, do you perceive the charge of your committee was violence committed against another person——

Dr. BUSHMAN. Yes.

Dr. HARRIS. Not just violence itself?

Dr. BUSHMAN. Yes. Violence committed against another person.

Dr. HARRIS. You know, I am just going to say I think, you know, you miss an opportunity there. I will just—again, and I thank you for agreeing that more study needs to be done with regards to anchoring in a faith that perhaps would lend more respect for life and the need to see whether that—how it is related. Again, I am going to share this point, Mr. Culberson, because I did look through this and I don't see any indication of it as an area for future study, but I thank you for agreeing to it in your verbal testimony, that perhaps it was just an omission from the document.

I think that is something we should—again, it is something we don't like talking about. Because, you know, it is religion and it is, you know, should the State be involved in this?

Look, it is—just as a scientist you and I both know that as scientists we don't worry about talking about—we shouldn't worry about talking about uncomfortable things.

Dr. BUSHMAN. Right.

Dr. HARRIS. And I think that is worth looking at for the reasons that have been brought up. Now, it may turn out that there is no correlation, but we should know it.

Dr. BUSHMAN. Well, I have done experimental studies myself showing that prayer can reduce anger and aggression. So, personally I have done it, but I agree that more research is needed.

Dr. HARRIS. Thank you very much. And thank you, Mr. Chairman, for bringing this topic up. It is a—again, to parents and grandparents, it is a critical topic and, you know, moms and dads, grandmas, grandpas around the country, they worry about this. They really do. And any light we can shed on it to prevent violence—again, I would urge that we do group suicide into violent behavior, because I think it does have the same roots and origins, as you can imagine, with aggression against others, aggression to yourself. And it would be—I think we would miss an opportunity. But, thank you, Mr. Chairman.

ROLE OF VIOLENT VIDEO GAMES IN RECENT MASS SHOOTINGS

Mr. WOLF. Okay. Thank you, Dr. Harris. I recently read in a *New York Daily News* article that Adam Lanza plotted the Sandy Hook shooting for years on a seven foot long, four foot wide spreadsheet. I quote, "They don't believe this was just a spreadsheet, they believe it was a score sheet." The cop, who wished not to be identified, continued, "This work was the work of a video gamer, and it was his intent to put his own name at the very top of the list." They believe that he picked an elementary school because he felt it was a point of least resistance where he could rack up the greatest number of "kills." That is what the Connecticut Police believe.

I am aware that you have also seen the report. Can you comment on this?

Dr. BUSHMAN. Well, we don't know for sure what cause—it is a troubling comment, and violent video games have been implicated in previous school shootings. But in terms of drawing cause-effect statements, it is not possible to know if playing violent video games caused Adam Lanza to do what he did. But we do know that they're correlated—playing violent games is correlated with violent behavior, such as choking and punching and beating and threatening people with guns and even using guns against others. And

we know that it causes less serious forms of aggressive behavior. But I don't know if it caused him to do what he did.

Mr. WOLF. Of the mass shootings, have video games been mentioned as a part of all of them?

Dr. BUSHMAN. Well, there have been—I think our report includes a list, Columbine High School——

Mr. WOLF. What was the involvement of video games at Columbine?

Dr. BUSHMAN. Well, Klebold and Harris, apparently, created their own customized version of "Doom" with two shooters who had unlimited weapons and unlimited ammunition and all the victims were unarmed.

Mr. WOLF. What are the other ones?

Dr. BUSHMAN. Bethel, Alaska; Paducah, Kentucky——

Mr. WOLF. Do what they——

Dr. BUSHMAN. I don't have that information.

Mr. WOLF. Give us the list.

Dr. BUSHMAN. Bethel, Alaska; Paducah, Kentucky; Jonesboro, Arkansas; and most recently Newtown, Connecticut within our country. And then in Norway, Anders Breivik, and also in France there was a case——

Mr. WOLF. What was the Norwegian—I had seen something about that. What was the involvement of video games in the Norwegian killings?

Dr. BUSHMAN. Well, he specifically said that he used the video game "Modern Warfare 2" to improve his shooting skills. To practice as a training and simulation tool.

Mr. WOLF. We know that Adam Lanza may have been emulating a video game as he moved room to room at Sandy Hook. Do you think that as youth struggling with mental illness, these shooters were more vulnerable to violent media effects?

Dr. BUSHMAN Yeah, the data we have indicate that some people are more vulnerable than others, but we need to do more research on the topic.

Of course, it is unethical to do laboratory experiments on the topic, because it is not ethical to expose vulnerable people to potentially harmful violent video games. But, we can measure their exposure, what they do, and measure their mental illnesses and see if there is a relationship between the two.

TESTING FOR A CONNECTION BETWEEN VIOLENT MEDIA AND VIOLENT BEHAVIOR

Mr. WOLF. Your specific research interests are focused on relations between exposure to violent media and subsequent aggressive or violent behavior. Your findings, as well as others as described in the report, show that a definite link exists between violent video games and aggressive thoughts, feelings, and behaviors. How did your research establish that link?

Dr. BUSHMAN. Yeah, well we reviewed every scientific study conducted on the topic—and every study has a quantitative affect such as a correlation—and we averaged the correlations across those studies.

Mr. WOLF. And how strong is that link?

Dr. BUSHMAN. I think the average correlation was about .20, like I explained before.

Mr. WOLF. Can you elaborate on the difference between saying that there is a link or a relationship between exposure to violent media and violent behavior and saying that one causes the other?

Dr. BUSHMAN. Absolutely. The only type of study that allows you to make cause-effect statements is an experimental study. And in an experimental study, we don't ask people if they want to play a violent game or a non-violent game, because if we did different types of people may choose to play the violent game. And if they're more aggressive afterwards, we don't know if it is because of the kind of person they were or the game they played.

And so, instead what we do is we choose the games, usually there are six violent games, six non-violent games. And we flip a coin to determine whether they play a violent or non-violent game and then roll a die to determine which one they play. And that way you cannot say, oh, all the aggressive people played the violent game because you flipped a coin to determine what game they played. So, there's a 50/50 chance that they played a non-violent game. Or you can't say all the people with mental problems played the violent game, or all the people with low cognitive skills played the violent game.

On average, on every single dimension you can imagine, those groups should be equal, especially if you have a large number of participants. Most of our experiments have 200 people, maybe 100 play a violent game, 100 play a non-violent game. Then you treat the groups identically. You're not nice to the non-violent game players and mean to the violent game players. You have standardized procedures and you treat the groups identically. The only difference is the game they play, and then you measure their behavior afterwards to see if the violent game players are more aggressive, such as shocking another person or blasting them with loud noise or getting into fights out on the playground, or if they're the same. You see different levels of aggression after they play the game. The only thing that could have caused that difference is the game they played or a random fluke.

And scientists are very careful to do stringent, statistical tests to minimize the likelihood of random flukes.

RECONCILING CONFLICTING SCIENTIFIC RESULTS ON VIOLENT MEDIA

Mr. WOLF. We often hear assertions that in the media that exposure to violent video games has nothing to do with violent behavior. There are individual researchers who make this argument, and last year the Supreme Court held that any correlation between the two is small and indistinguishable from the impact of other factors. Why do you believe that your research findings are correct and these other findings are wrong?

Dr. BUSHMAN. I can't imagine how the U.S. Supreme Court could have made that decision, because I personally sent our meta-analysis to every single Justice of the Supreme Court. So, I am not sure. Of course, they are not scientists and they are not in a position to evaluate scientific evidence, but I don't know how they could make such a claim.

POLICY PRESCRIPTIONS FOR DEALING WITH IMPACTS OF VIOLENT MEDIA

Mr. WOLF. Many previous attempts to address the problem of violent video games have run into Constitutional problems and First Amendment concerns. Are there practical steps that you are aware of to mitigate the negative effects of violent video games without running into Constitutional concerns?

Dr. BUSHMAN. I think there are things that we can do as a society. I was trying to explain earlier to Mr. Rooney that in the Netherlands there is a universal rating system for TV programs, video games, movies, and I have been to the place that does the ratings. First of all, they are not industry assigned. They are assigned by professional raters who play the games and give it a rating. And there are child development experts on the panel who are consultants. So, it is not a rating assigned by the industry.

They say that we have two goals, Number one, to inform parents. Number two, to protect children. And it is very simple. They have "plus 12" for 12 and older; "plus 16" for 16 and older, for every form of media. If there is violence on it they have a fist, If there is profanity, they have a bubble with characters in it. And it is very easy for parents to understand these ratings.

In America, it is like alphabet soup. There is R for movies, TV MA for television, MBG for mild blood and gore. Most Americans, you ask a parent, what does TV MA mean? I don't know. And that rating is only on the TV program for 30 seconds. In the Netherlands it is on the corner the whole time. So, a parent can walk in the room any time and see what the rating of that program is or the video game their child is playing or the movie they are watching.

The Surgeon General in 1972 issued a warning on violent television programs. We know the Surgeon General in '64 issued a warning on tobacco products. Yet, the Surgeon General warning is on every tobacco product, and there is no Surgeon General warning on any violent media product. I am not sure why.

Also, we could have media literacy programs to teach children to be more intelligent consumers of media.

Mr. WOLF. So, you may have some lobbyists out here who are paid very well by the electronic gaming industry. I assume some of these great reporters that we have here are going to tell the fair and objective report. What message, because you said the two purposes were, one, to what? To help the——

Dr. BUSHMAN. To inform parents.

Mr. WOLF. Now, I think everyone would be—you would hope the industry would want to inform parents.

Dr. BUSHMAN. But I think they confuse parents.

Mr. WOLF. But we would think that——

Dr. BUSHMAN. Hopefully, yes.

Mr. WOLF. And what is the other one?

Dr. BUSHMAN. To protect children.

Mr. WOLF. To protect children. So, you would think everyone would want to protect children.

Dr. BUSHMAN. I would hope so.

Mr. WOLF. We're not really talking about 21-year-old people, are we?

Dr. BUSHMAN. No.

Mr. WOLF. We are talking about children.

Dr. BUSHMAN. That's right.

Mr. WOLF. Okay. So, why would the industry be opposed to doing that?

Dr. BUSHMAN. Having a universal rating system? I don't know.

Mr. WOLF. Who is with the industry here? Raise your hand. Is there anybody—are any of you lawyers that are representing the industry here? Should we swear in a whole panel and put you under oath? For some reason I don't completely believe you. Why would they be opposed, though, to protecting children? You're really telling me that we are not talking about, a 21 year old——

Dr. BUSHMAN. No. An 18 year old, 18 and above, yes.

Mr. WOLF. So, we are talking about a 12 and 13——

Dr. BUSHMAN. Yeah, any child under 18.

Mr. WOLF. Why would the industry be opposed to that?

Dr. BUSHMAN. I think because mainly they care about money rather than those issues. I know that when Jack Valenti was still alive, I sent him all the research evidence about ratings and recommended a universal rating system after the 1994 Telecommunications Act when they were deciding about what kind of ratings to put on television programs. I said, at least make them the same as movies, so parents know what the ratings are. But instead they came up with totally different system that parents don't understand.

Mr. WOLF. So, that would be more helpful for a parent because then it would be uniform——

Dr. BUSHMAN. Yes.

Mr. WOLF. Does anybody out here want to get up and take the industry position on why they would be opposed to this? I mean, as a father of five and a grandfather of 16, why would they be opposed to that?

Dr. BUSHMAN. I am not sure. The industry doesn't talk to me. They hate me, I think.

Mr. WOLF. We know that violent video games have played a role in some of these large tragedies. I think that Congress ought to do what it can to stop this, and I think your point is well taken. We're talking about young people. We're not talking about 18 year olds, we're not talking about 21 year olds, 25. And to give the parents more and more information is very important.

So, I have some more questions, but I think that makes the point that I wanted to make. I appreciate you——

Dr. BUSHMAN. Sure. My pleasure.

Mr. WOLF [continuing]. Testimony. I appreciate the NSF, and if you would also thank the other panel members for their participation.

Dr. BUSHMAN. Absolutely. Yes, will do.

Mr. WOLF. And with that, I see the place is empty.

Dr. BUSHMAN. Okay.

Mr. WOLF. The hearing is adjourned. Thank you.

Dr. BUSHMAN. Okay. Thank you.

QUESTIONS FOR THE RECORD FOR DR. SURESH—MR. WOLF

SOCIAL, BEHAVIORAL AND ECONOMIC SCIENCES

Question. A recently adopted amendment to NSF's fiscal year 2013 appropriations bill seeks to limit spending on political science research to only those grants with a certified link to economic or national security. How does NSF plan to implement this limitation?

Answer. NSF is currently developing a plan to implement this restriction on the Political Science program, which will take into account both the legislative requirements and NSF's existing policies and procedures.

Question. What is the expected impact of this amendment on the amount and kind of political science research that you will fund?

Answer. We expect that the portfolio of awards will be intellectually constrained, because a narrower set of requirements has been imposed for this program alone. The restrictions in the legislation will curtail our ability to support research projects that would further fundamental knowledge of how democracies are created and maintained as well as connections between the governed and their government, which seems particularly germane in the wake of Arab Spring and more broadly in the wake of thirty years of efforts to understand and improve democracy around the world. In the long term, these types of restrictions will have a chilling effect on NSF's ability to support basic research across its entire scientific portfolio.

CROSS FOUNDATION INITIATIVES

Question. Does the agency's recent emphasis on "OneNSF" initiatives imply that NSF has historically been too stove-piped in its research approach?

Answer. OneNSF is an organizational philosophy that emphasizes the need to continuously look for linkages in research and learning that might transcend disciplines to advance more effectively science, engineering, and education. In fact, depth in traditional research disciplines and cross-collaborations is required to tackle increasingly complex scientific questions.

Question. In just a few years, the OneNSF initiatives have come to consume a significant part of the agency's total budget, which means that NSF has become increasingly focused on programs addressing a few predetermined research goals. Is this focus pushing NSF to become more like a mission-specific research agency and less like a basic research agency, whose research focus goes wherever the science takes it?

Answer. All NSF programs support the Foundation's mission "to promote the progress of science, to advance the national health, prosperity, and welfare; to secure the national defense and for other purposes." NSF's initiatives temporarily crystalize funding opportunities that are particularly ripe for scientific advancement or address high priority national needs. While some initiatives promote basic research to support specific national needs, this is a fraction (about 12 percent of the FY 2014 request) of NSF's overall support for research and education.

Question. How does the management of the OneNSF initiatives differ from the management of a typical NSF program? How have you made these differences transparent and understandable to the research community?

Answer. Most NSF initiatives are managed in the same way they were developed. There is a program announcement or solicitation that results in proposals that are reviewed according to well established processes. These processes are either specified in the solicitation or found in the Proposal and Award Policies and Procedures Guide. Webinars, posting of FAQs, presentations at conferences, and other forms of communication commonly are used to explain NSF's management practices to the research community. This is especially important when NSF is piloting new procedures, such as those being used to manage INSPIRE.

Question. Some directorates have had to reduce the funding available for their core programs and infrastructure in order to make their contributions to the OneNSF initiatives. What process do you use to make the trade-offs between decreasing funding for existing programs and providing money to initiate new programs?

Answer. Initiatives support areas that are ripe for scientific advancement or address a high priority national need. The decision to allocate funding to an initiative rather than to another program or funding opportunity is based on where the possibility is greatest for significant programmatic outcomes. By supporting a diverse portfolio of research funding opportunities, NSF has been able to support transformative research across the frontiers of science, engineering, and education.

NSF HEADQUARTERS

Question. The prospectus for a new NSF headquarters facility has been approved by the House but not the Senate. What do you know about the status of the Senate's consideration of your prospectus?

Answer. NSF's FY 2011 prospectus for a new NSF headquarters lease was approved by the Senate Committee on the Environment and Public Works on April 18, 2013.

Question. What is the latest that you could receive Senate approval without impacting GSA's planned schedule for awarding a new NSF headquarters lease?

Answer. Given the recent approval of the NSF prospectus by the Senate Committee on Environment and Public Works, there is no anticipated impact on GSA's schedule to award the lease during the summer of 2013.

Question. What impact would a potential delay in the lease award have on NSF's headquarters planning? Would such a delay increase your budget needs associated with the new headquarters lease?

Answer. GSA informs us that the NSF lease procurement was extremely competitive and will yield extraordinary economic advantages resulting from the current inexpensive financing market. With the approval of the NSF lease prospectus by the Senate Committee on Environment and Public Works on April 18, 2013, we believe the benefits of GSA-negotiated financing terms can be realized. Because the procurement will not be delayed, no additional NSF budgetary requirements are anticipated at this time.

SECURITY

Question. The NSF Inspector General has told us that the number and level of sophistication of hacking attempts on NSF information technology systems has increased. Are your IT security protections keeping pace with the increased threat?

Answer. The number of IT security threats continues to increase at a rapid pace, and attackers display an increasing level of sophistication. With recognition that the threat landscape is constantly evolving, NSF continuously monitors potential threats and is proactive about preventing and addressing them. NSF faces threats that are common to all agencies, including attempted attacks from external networks, zero day threats, phishing schemes, and the potential for insiders with malicious intent. We use a combination of technologies and user education to help mitigate the risk associated with these threats.

NSF's vulnerability management program employs layers of defense against potential threats. We continuously monitor systems, network devices, workstations, laptops, and mobile devices to quickly identify security vulnerabilities. Our vulnerability remediation activities are centrally tracked and managed.

We have strengthened our patch management processes and activities in accordance with National Institute of Standards and Technology (NIST) recommendations.

NSF employs intrusion detection systems to monitor internal and external network traffic on a continuous basis. With the Foundation's transition to the Trusted Internet Connection (TIC) service, NSF relies on the CenturyLink Security Operations Center and the Department of Homeland Security's intrusion detection system, along with NSF's onsite network operations center, to provide 24/7 monitoring. Should we identify areas of potential exposure, we move quickly to mitigate risks.

User education is an important part of NSF's strategy to stay ahead of cybersecurity threats. We regularly advise and train agency staff about their responsibilities for protecting agency information.

NSF's cybersecurity activities have helped us to keep pace with external threats, even as new ones continue to emerge. As reported to US-CERT, NSF's average number of security incidents per year remains in the single digits. However, NSF recognizes the importance of continually reviewing and enhancing our overall security posture. For example, we consistently evaluate our IT security tools to ensure they remain current and effective in light of emerging challenges. NSF will continue to be proactive in monitoring the growing number and types of cybersecurity threats.

Question. One potential weakness that your IG has highlighted is NSF's lack of a formal cybersecurity incident response plan. Why doesn't NSF have such a plan? What risks are created by not having a standardized set of policies and procedures to follow whenever an incident occurs?

Answer. NSF has a standard set of policies and procedures for incident response. NSF's incident response policy and procedures reflect National Institute of Standards and Technology (NIST) guidance and practical experience gained from previous incidents. Our policy and procedures include guidance for consistent handling of computer security events at NSF, including event containment, eradication, and recovery, as well as procedures for notifying NSF management, US-CERT, and law enforcement, if necessary.

As part of our FY 2012 Federal Information Security Management Act (FISMA) review, the NSF Office of the Inspector General recommended that NSF update our existing incident response policy and procedures, and formalize our processes for categorizing, tracking, and reporting incidents. NSF management is currently updating our incident response policy and procedures and is documenting a formal cybersecurity incident response plan, commensurate with NIST 800–53 guidance, to include US-CERT incident categorizations and severity ratings.

Question. What policies do you have in place to ensure that your grantees are complying with export control laws and regulations in all relevant instances?

Answer. NSF grantees have full responsibility for the conduct of the project or activity supported under the grant, including compliance with all applicable laws. Grantees are provided notice of certain critical legal requirements, among which are the Export Administration Regulations, and in accepting the award, affirmatively agree to comply. To ensure compliance, grantees develop their own export control plans and seek the necessary licenses, permits and approvals prior to undertaking proposed relevant activities.

MONITORING AND IMPLEMENTATION OF K–12 STEM EDUCATION REPORT RECOMMENDATIONS

Question. NSF released a report in 2011 on best practices in K–12 STEM education. There were a number of public events at the time to get that report into the hands of education practitioners and policymakers who could implement its findings, but your efforts to disseminate that report have continued since the report's release. What is the current status of your dissemination efforts?

Answer. The report, Successful K–12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering and Mathematics and its findings have been disseminated by a variety of means, including:

Workshops

- In September 2011, a national roll out of the 2011 NRC report took place at Drexel University in Philadelphia. Congressman Fattah, members of Congressman Wolf's staff, NSF leadership, and representatives from the U.S. Department of Education took part in this event.

- Four regional "STEM Smart" workshops based on findings of the 2011 report targeted state- and district-level practitioners and education researchers in Seattle, Chicago, Las Vegas, and Baltimore. These workshops took place between February of 2012 and March 2013 and featured sessions and exhibits drawn mostly from NSF research projects that are aligned with the recommendations in the report. Materials and resources from the workshops can be found on the successfulstemeducation.org website.

- NRC staff presented at the 2012 annual meeting of the National Science Teachers Association (NSTA) in Indianapolis, and at a conference in Pittsburgh for 350 math and science educators and administrators

representing the 138 schools in the Pittsburgh metropolitan region (October 2011).

Print Dissemination

- Copies of the 2011 NRC report have been distributed at major professional meetings such as NSTA and the National Council of Teachers of Mathematics (NCTM).
- Copies of the 2011 NRC report have been widely disseminated to the National Science Board, the EHR Advisory Committee, NSF staff members, and to EHR principal investigators.
- As of March 2013, 14,604 free copies of Successful K–12 STEM Education were downloaded from the NRC web site, and nearly 5,000 print copies had been sold.
- The Smithsonian's National Science Resource Center purchased and disseminated 300 copies at Science Education Institutes for Leadership Development and Strategic Planning meetings in North Carolina and New Mexico. During the events, leadership teams from school districts developed a long-range plan to enact systemic change in their district, with the goal of implementing and expanding a research-based science education program for students.
- In June and July 2011, report committee member Jerry Valadez, a professor at California State University in Fresno, disseminated 100 copies to directors of the California Science Project and staff of the Oakland Unified and San Francisco Unified School Districts.
- National Academies Press provided 200 copies to a STEM Summit focused on bringing the Pittsburgh region the best information about successful STEM-education strategies by using cutting-edge research and other examples from throughout the region.
- NSF distributed approximately 1,500 copies at the national roll-out event in Philadelphia and the four "Smart STEM" regional meetings.

Professional Societies and Policy Organizations

- Briefings on Successful K–12 STEM Education have been held with major policy organizations, such as the National Governors Association, the Council of Chief State School Officers, the Council of State Science Supervisors, and the National Conference of State Legislatures, to initiate conversations about policy implications of the report.

- The report was featured at a June K–12 STEM Education Summit organized by U.S. News and World Report in Dallas.

- Report committee chair Adam Gamoran gave keynote speeches at meetings of the Southern Region Education Board State Leaders' Forum in Jacksonville, Fla., (November 2011), and at the annual meeting of the Oak Ridge Associated Universities in Tennessee (March 2012). Gamoran, committee member Barbara Means, and an NSF representative participated in a panel discussion of the report at the annual meeting of the American Educational Research Association in Vancouver, Canada (April 2012).

Congressional Communications

- In October 2011, report committee chair Adam Gamoran and member Barbara Means, Board on Science Education (BOSE) member Suzanne Wilson, and two others testified at a hearing on "What Makes for Successful K–12 STEM Education" before the House of Representatives Committee on Science, Space, and Technology Subcommittee on Research and Science Education.

- In June 2011, Adam Gamoran briefed staff from EHR and members of the House of Representatives Committee on Appropriations, Subcommittee on Commerce, Justice, Science, and Related Agencies.

- NSF was one of 13 organizations (federal agencies and scientific societies) that participated in an event at the Rayburn House Office Building entitled "Celebrating U.S. Science and Engineering." Invitees included members of Congress, their staff, scientists and engineers, and students. The event was facilitated by the Alliance for Science & Technology Research in America and Institute of Electrical and Electronics Engineers (IEEE). The NSF display featured the report along with issue briefs developed for the "STEM Smart" regional meetings. About 300 postcards with information about how to obtain the reports were distributed.

- In January 2013, NSF engaged in conversations with staff members from Representative Wolf's office about holding a STEM event in his district (scheduled for September 27–28, 2013) based on findings of the report and other developments.

Question. Late last year, the National Research Council released a list of 14 key indicators that would allow NSF to track the implementation of the recommendations contained in the best practices report. What steps have

you taken to begin collecting data on those indicators? How long do you estimate it will take to get a complete monitoring scheme in place for all 14 indicators?

Answer. The Directorate for Education and Human Resources, in consultation with the National Center for Science and Engineering Statistics, has developed a five-year plan to collect data on the indicators identified by the National Research Council (NRC) and published in the 2013 report Monitoring Progress Toward Successful K–12 STEM Education: A Nation Advancing? In FY 2014, NSF will determine the current state of the STEM indicators, analyze and report existing data, and identify data sources that could be expanded to include the data called for in the NRC report. Further, a summary of the NRC report will appear in the 2014 Science and Engineering Indicators issued by the National Science Board. Also starting in FY 2014, and continuing through FY 2015, NSF will be working to ensure that newly developed indicators align with the recommendations in the NRC report. The final phase of the plan, establishing a research and development agenda for the development and tracking of new success indicators, is expected to take place from FY 2014 to FY 2019.

NSF has already begun to lay the groundwork for the phases of this plan by holding meetings around this topic with key groups in the Department of Education, such as the National Center for Education Statistics, those involved in Race to the Top Grants, and those responsible for the State Longitudinal databases at the Institute of Education Sciences, whose cooperation will be necessary to accomplish this plan. By FY 2019, plans will be in place to collect data on all 14 indicators.

RECOVERY ACT FUNDING

Question. OMB gave you the option to seek waivers to allow certain Recovery Act awards to continue expending funds beyond the government-wide September 30 deadline. How many waivers did you seek, and how much funding is covered by those waivers?

Answer. NSF's waiver request was comprised of 512 awards totaling $133.60 million (less than 5 percent of ARRA obligations). Specifically, it included: Faculty Early Career Development program (CAREER) (304 awards, $20.0 million out of $165.0 million); Robert Noyce Scholarship program (59 awards, $12.60 million out of $59.0 million); and a multi-programmatic request, comprised of (149 awards, $101.0 million out of $555.0 million).

Question. The Recovery Act was enacted with the goal of providing a short term stimulus to an economy in major crisis. At this point, four fiscal years

later and amidst a stronger general economy, that justification is much less compelling for the use of your remaining unspent Recovery Act funds. What is the justification you used for seeking waivers to continue paying out some of these awards?

Answer. NSF's primary economic impact in connection with the Recovery Act is to advance the long-term goals—innovation and reinvestment—inherent in the statement of purpose set forth in Sections (3) & (4) of the Act. §(3), "to provide investments needed to increase economic efficiency by spurring technological advances in science and health"; and §(4), "to invest in transportation, environmental protection, and other infrastructure that will provide long-term economic benefits". As justification for seeking waivers, the Foundation utilized the criteria set forth in OMB Memorandum M-11–34 including projects that were long-term by design, had contractual commitments, environmental considerations and other special circumstances. NSF sought waivers to continue paying out only about 10 percent of the grant agreements in NSF's Recovery Act portfolio. NSF's request was narrowly tailored to only include those awards that the Foundation determined met the M-11–34 criteria, and the agency estimates that there will be less than 5 percent of the total Recovery Act funds obligated remaining unexpended after the expenditure deadline of September 30, 2013.

Question. What have you heard from OMB about the status of your waiver requests?

Answer. With regard to the Recovery Act awards included in NSF's agency waiver package, NSF received approval from OMB on April 29, 2013, for all outstanding requests. NSF has instructed awardee institutions that Principal Investigators (PIs) should proceed with work in accordance with the terms and conditions of the award while continuing to responsibly accelerate when possible.

U.S. ANTARCTIC PROGRAM

Question. Please provide a list of any of the 84 actions recommended by last year's Antarctic Blue Ribbon Panel with which NSF does not agree or does not currently have sufficient information to implement.

Answer. NSF is engaged with its Department of Defense (DoD) partners to explore the feasibility of implementing recommendations made by the Blue Ribbon Panel. Two primary topics under discussion are the recommendations to reduce the operational LC-130 fleet from ten to six aircraft, and to construct a compacted snow runway at South Pole Station to allow wheeled aircraft operations. While NSF believes that construction of such a runway is

technically feasible, there are many operational issues associated with landing wheeled aircraft at the South Pole (such as infrastructure and equipment for fire and emergency response, refueling, and cargo handling) that must be understood in order to conduct a cost-benefit analysis. NSF is also updating the master plans for McMurdo and Palmer stations that will guide decisions on recommendations related to, for example, fire protection, consolidated warehousing, and energy improvements. NSF's Response to the Blue Ribbon Panel report may be found at: `http://www.nsf.gov/news/news_summ.jsp?cntn_id=127345&org=NSF&from=news`

Question. One of the Blue Ribbon Panel's "concluding observations" was that a temporary reduction in spending for Antarctic science activities could help to free up funds for critically needed logistics and infrastructure improvements. Does NSF support this idea?

Answer. NSF is implementing this recommendation by ensuring that a portion of Antarctic science funding is directed towards developing and improving remote sensing instrumentation and other technologies that will increase the efficiency of the enterprise and make it possible to support more science. NSF management has and will continue to communicate this approach to the community through, for example, U.S. Antarctic Program channels, public forums, and conferences.

Question. Lockheed Martin told us that they incorporated many of the fiscal and process improvements recommended by the Blue Ribbon Panel into their contract bid. Do you agree with this statement? If there are additional savings measures that can be implemented beyond what Lockheed assumed in its bid, how can those additional measures be incorporated into their contract?

Answer. Yes, many of the fiscal and process improvements recommended by the Blue Ribbon Panel were included in Lockheed Martin's proposal. NSF works very closely with Lockheed Martin to ensure an environment of continuous fiscal and process improvements. When identified, these improvements are incorporated either by making adjustments to Annual Program Plans or via official modifications to the contract.

Question. What is the status of your efforts to close out the previous Antarctic logistics support contract?

Answer. GEO's Polar Division is working with the Division of Acquisition and Cooperative Support to contract for the incurred cost audits that are required before the final invoice can be paid. This process is expected to be completed in the summer of 2014

Table 1: NSF's Climate Change Expenditures

(Dollars in Millions)

	FY 2010 Enacted	FY 2011 Enacted	FY 2012 Enacted	FY 2013 Budget	FY 2014 Request
USGCRP	$320	$321	$333	$333	$326
CET	324	312	341	355	372
IA	3	6	6	6	3
Total, NSF	$647	$639	$681	$694	$702

CLIMATE CHANGE RESEARCH

Question. NSF tracks and reports on its investments in the U.S. Global Change Research Program, but this is only a portion of what the agency spends on climate change science in a given year. How much does NSF spend on climate change each year, across all activities? How have your investments in these activities changed over the last five fiscal years?

Answer. NSF reports expenditures for not only the U.S. Global Change Research Program (USGCRP), but other categories of climate change research as well. Investments in Clean Energy Technologies (CET) help to reduce, avoid, or sequester greenhouse gas emissions. International Assistance (IA) programs demonstrate continued U.S. leadership in forging a global solution to the climate challenge and helping developing countries focus their climate investments strategically over the coming years, and creating robust means of measuring, monitoring, and verifying domestic emissions in developing countries. Both of these types of investments reduce vulnerability to climate change.

These data are also reported to Congress by the Office of Management and Budget (OMB) in the Federal Climate Change Expenditures Report to Congress.

Overall, NSF has seen a relatively stable 8.5 percent growth in climate change expenditures over the last five years, which is similar to overall NSF growth (the FY 2014 Request is 10.9 percent above the FY 2010 Enacted level). However, the substance of the climate change investments has evolved over time. The new USGCRP Strategic Plan released in April 2012 places a greater emphasis on providing the information needed to respond to global change impacts and vulnerabilities. Accordingly, NSF programs are encouraging more interdisciplinary efforts, which not only will advance scientific knowledge of the integrated natural and human components of the Earth system, but also provide the scientific basis to inform and enable stakeholders to make timely decisions on adaptation and mitigation actions. This trend toward more

interdisciplinary activities across the spectrum of climate change activities at NSF is particularly prominent in NSF's Science, Engineering, and Education for Sustainability (SEES) program, which has significant elements related to climate change.

Question. Last year the House voted to approve an appropriations amendment that would prohibit NSF from spending funds on the Climate Change Education Program. What do you believe would be the impact of such an amendment being enacted? Could your other more general STEM education programs serve the same purposes as the climate change-specific program?

Answer. The Climate Change Education Program (CCEP), initiated by Congress in FY 2009, made six awards in FY 2012 and one in FY 2013; the awards ranged in size from $1 million to $5 million for periods of four to five years. As continuing grants, many of the awardees have received only a portion of their total funding. In the FY 2014 Budget Request, CCEP is consolidated into the new NSF-wide Catalyzing Advances in Undergraduate STEM Education (CAUSE) program. CAUSE will integrate and leverage NSF's investments in undergraduate education to advance STEM education and workforce development. CAUSE will provide for continuing CCEP commitments in FY 2014, 2015, and 2016. No new CCEP awards will be made.

WORKFORCE MANAGEMENT

Question. NSF has seen recent decreases in employee satisfaction as measured by the OPM Employee Viewpoint Survey and the Partnership for Public Service's Best Places to Work in Government ratings. Why do you believe this is the case, and what steps is NSF taking to reverse this trend? What additional steps do you believe are necessary?

Answer. The National Science Foundation (NSF) is committed to being among the best places to work in the federal government. The Federal Employee Viewpoint Survey (FEVS) results confirm many of the positive aspects of NSF: our staff is highly motivated; we put in extra effort when needed to get the job done; we are constantly looking for ways to do our jobs better; and we know the work we do is important. Our workforce is excited about our mission and knows that the results from awards we make inspire the imagination while advancing the progress of science, contributing to a prosperous and secure nation. At the same time, the FEVS identifies areas where employee perceptions do not demonstrate the level of organizational excellence to which we all aspire. NSF has initiated specific actions aimed at improving the NSF climate: workload, performance management and

recognition, career development, and career-life balance.

1. *Workload*—Although NSF employees believe the workforce has the right knowledge and skills to accomplish the Foundation's goals, workload continues to be the area with the largest unfavorable discrepancy between NSF and the government-wide average. NSF will continue its workload modeling efforts and some experimental activities aimed at controlling workload, while more in-depth discussions get at the nature of the dissatisfaction.

2. *Career Development*—FEVS data indicate a continued downward trend in training and development indicators, including assessment of training needs and specific training to improve job performance, as well as opportunities for advancement within NSF.

3. *Performance Management and Recognition*—Our 2012 survey results revealed some encouraging increases related to performance management, which the Foundation attributes to improving performance management training for supervisors and employees and to implementing performance management for IPAs. However, some FEVS indicators and anecdotal evidence from employees and management indicate that performance management and related rewards and recognition require continued improvement.

4. *Career-Life Balance*—Like most organizations in both the Federal government and the private sector, we have spent the past several years placing a strong emphasis on the importance of career-life balance. As such, the Foundation has supported telework and other career-life initiatives geared toward improving morale and employee satisfaction, and we plan to continue to improve these areas.

The FEVS is an important set of indicators to be used, along with other tools and information, to address our commitment at NSF to continual improvement of the workplace culture and climate. NSF has developed its FEVS Action Plan (available at `http://www.nsf.gov/about/career_opps/fevs_nsfactionplan_2013.pdf`) to address these four areas along with overarching activities related to leadership and communications. FEVS analyses also identified disparate opinions across internal organizations indicating that implementing "local" solutions could significantly contribute to improving culture and climate at the organization level. As such, each directorate and office has developed its own focused plan based upon the review of its local FEVS data and other pertinent information. NSF is tracking the progress of

these action strategies to identify best practices that may be scalable to the entire organization.

Question. One of NSF's more unique workforce characteristics is its heavy use of "rotators", or non-Federal employees who work temporarily at NSF. How has NSF's use of these rotators changed over time? Are they becoming more common, or filling different types of jobs than was previously the case?

Answer. NSF's use of rotators has remained steady in all categories over the last five years. Visiting Scientists (VSEEs) and Intergovernmental Personnel Act assignees (IPAs), known collectively as rotators, made up between 13 and 15 percent of NSF's overall workforce each year during the period between FY 2008 and FY 2012. NSF has not seen a notable change in either the rate at which it uses rotator appointments or the type of positions it fills with them.

Question. One of the most common means for hiring non-permanent employees is through the Intergovernmental Personnel Act (IPA), which allows an influx of outside technical expertise to the agency but is also very expensive. In fact, the OIG estimated that NSF's use of IPAs created $6.7 million in added costs in fiscal year 2012 alone. Is the value NSF receives from bringing in these IPAs always worth the added cost above hiring a regular Federal employee? What kind of analysis have you done to support your conclusions?

Answer. NSF relies upon the expertise of some of the Nation's leading scientists, engineers, and educators to execute its mission, thereby ensuring our Nation remains at the forefront of scientific and engineering discovery. We believe the use of IPAs strengthens the ties between NSF and the communities it serves, and the flow of ideas and experience both ways enriches the science and engineering enterprise and enhances NSF's intellectual capacity. Individuals serving at NSF under the Intergovernmental Personnel Act come from universities and institutions throughout the nation. The active participation of these respected and highly skilled scientists, engineers and educators is important to NSF in ensuring that the best research is being funded with taxpayer dollars. Having the IPA as one of our tools for recruiting rotators enables NSF to tailor a compensation package to the circumstances of those we are trying to recruit so that their losses for public service at NSF are minimized and balanced by the benefits of being at the forefront of the research process. As a practical matter, we find we would be unable to attract this talent if we were restricted to paying for their services under the current Federal pay scale. Consequently, NSF strikes a balance between a highly educated permanent workforce that creates stability and helps retain institutional knowledge, and individuals who bring fresh ideas and new approaches

to research at the frontier. Overall, the impact of rotators in our merit review and award oversight processes more than compensates for the potential added cost of bringing them to NSF as IPAs.

In response to the OIG report on IPA costs, NSF is planning to conduct a review of those costs to determine where efficiencies or policy changes may reduce the overall cost of the IPA program to NSF.

Question. Many NSF executives are IPA employees who don't necessarily have any experience managing a Federal agency, and they only stay on the job for a few years before returning to their non-Federal positions. What kind of risk does this leadership strategy pose to the agency's management? How are these risks being mitigated?

Answer. IPA assignees in executive positions typically bring with them a wide variety of management experience, including academic positions such as university presidents, provosts, vice provosts, deans and department chairs, as well as directors of research-based organizations. They have experienced most of the key elements of management, including managing budgets, hiring and managing employees (including subordinate managers), conducting and managing research projects, evaluating research proposals, and long range planning. Therefore, we believe the risks of this strategy to agency management are minimal.

However, NSF understands that there are some risks associated with this strategy, and manages those risks using two primary sets of tools: 1) ensuring an appropriate balance in the composition of the executive corps in each of its organizations; and 2) having an active training program for all executives. For example, the New Executive Transition (NExT) Program is designed to enable new executives (both Career and IPA) to quickly reach their full potential and to provide existing managers with the tools and resources for effective leadership. NExT is designed to enhance NSF's capacity by quickly and effectively integrating new members of the executive corps by aiming to:

1. Develop executive knowledge about NSF mission, culture, organization, people, and business processes.

2. Provide executives the tools, information, skill-enhancement, and support to reach full performance as quickly as possible.

3. Support transitions into NSF executive positions from outside the government, from other Federal agencies, & from within NSF.

Question. What kind of protections are in place to ensure the independence of IPAs, who may be in a position to make decisions about research awards

affecting themselves or their home institutions? Do you believe the existing protections are sufficient?

Answer. Like regular employees, IPAs are subject to criminal conflict of interest statutes (statutes) as well as the Government-wide Standards of Ethical Conduct of Employees of the Executive Branch (regulations) which prohibit IPAs from participating in NSF proposals and awards affecting themselves and their home institutions. To bolster awareness of and compliance with these statutes and regulations, IPAs, like regular federal employees who file financial disclosure reports, are subject to mandatory conflict of interest training. IPAs, like regular federal employees who make award recommendations must file financial disclosure reports. Failure to file may result in disciplinary action (those required to file public reports are subject to statutory fines for failure to do so). Conflicts checks are part of the ethics program to avoid situations wherein IPAs make decisions about in their research awards or those of their home institution. NSF ethics officials counsel IPAs and regular employees to avoid even the appearance of conflicts, and recusal from matters is a common mechanism to prevent even an appearance of impropriety. NSF firmly believes that these protections are sufficient.

RESEARCH MISCONDUCT

Question. NSF requires that each grantee certify that it has a plan to address and prevent research misconduct. However, it is largely up to the grantees to decide what to put in their plans; NSF only offers examples and best practices. Why doesn't NSF establish more concrete requirements and criteria that each plan must meet?

Answer. NSF believes that the research community, encompassing both individual researchers and institutions, is best placed to determine the content of Responsible Conduct of Research ("RCR") training without a need for NSF-specified standards. NSF recognizes that specific training needs may vary depending on specific circumstances of research or the specific needs of students intending to pursue careers in basic or applied science after completing their education. Therefore, it is the responsibility of each institution to determine both the content and the delivery method for the training that will meet the institution's specific needs for RCR training in all areas at that institution for which NSF provides support. Furthermore, each institution must decide if development of content or pedagogical methods is required, or if appropriate content and training can be provided from some existing sources or capabilities, and then take appropriate action to implement their decisions.

Question. How often does NSF review grantees' research misconduct plans

for adequacy? Is there a regular, comprehensive review process, or are plans checked only on a case-by-case basis?

Answer. NSF can ask to see a proposer's RCR plan at any time after a proposal for funding is submitted. Therefore, if a Program Officer or Grants Officer has a concern about how RCR will be addressed during the project, they can request to see the plan before making a funding decision. Additionally, plans may be reviewed by NSF when deemed necessary post-award, to ensure implementation is proceeding as committed.

Questions for the Record for Dr. Bushman—Mr. Aderholt

Question. Your testimony outlines the differences in the ways rampage shootings in schools differs from "street violence" in urban areas. Does the NSF report look at research done on both of these types of youth violence or just on the school rampage shootings? Or is the research not broken down in these categories?

Answer. Yes, our report focuses on both types of violence. Rampage shootings in schools are very rare, but absolutely devastating because the motive is to destroy a community with very low levels of background violence through the death of its most innocent members. Street violence is far more common, victimizes thousands more children and adults, but it often somewhat easier to comprehend (though no less acceptable) because of the link to illegal behavior and the relatively higher levels of background violence on the streets.

The "ecology" of these forms of violence differs in dramatic ways, as do the risk factors. Rampage shootings in schools tend to involve young men who are in the high end of the academic spectrum, attacking schools that are in relatively prosperous, but geographically isolated regions. They experience high levels of social rejection, and seek to ingratiate themselves into peer groups through anti-hero behavior. Gun violence in poor urban neighborhoods generally involves young men who are poor academic performers, often connected to dispute settlement in illicit markets, and rarely targets schools. In both types of gun violence, access to weapons is a critical ingredient, but the access patterns differ. Rampage shooters in schools are likely to acquire weapons by stealing them from relatives, while gun violence in poor, urban neighborhoods often intersects illicit gun markets on the streets.

Question. Your testimony discussed the causal effects of violent media on people of all ages. I understand that exposure to violent media does not "cause" violent behavior, but there is a correlation. I also understand that you cannot prove in an experiment that there is a causal link. However, has

there been research done on whether or not there is a tipping point between aggressive thoughts / aggressive behavior and violent behavior?

Answer. Let me begin by clarifying what I meant. You said, "I understand that exposure to violent media does not 'cause' violent behavior, but there is a correlation." What I said is we are not in a position to know whether violent media causes violent behavior that involves actually shooting others with guns. We cannot ethically conduct experiments on gun violence. That is not the same thing as stating that violent media do not cause violent behavior.

Although one is unlikely to ever be in a position to directly study causal effects of violent media on gun violence per se (because of the unethical nature of any such research), violent media is one of the few classes of variables for which there IS clear causal evidence for its effects on aggression. We also have longitudinal studies that link violent media exposure to real world violence, so although this is not a tipping point, it is suggestive of a dose-response relation (i.e., the bigger the dose of violent media, the more aggressive the child is likely to become). Taken together, these various pieces of evidence suggest that the consumption of violent media can play a role in violent behavior.

In fact, numerous experimental studies have demonstrated a causal link between exposure to violent media and aggressive behavior.[1], [2], [3] To establish cause-effect relationships, researchers must use experimental studies. In an experimental study, participants are randomly assigned to groups that are exposed to different treatments (e.g., to play a violent versus a nonviolent video game). Except for the game they play, participants are treated identically. Because the assignment to group was random, the exposure to the violent video game is random and not a matter of what the individual chose or preferred. Thus, differences found between the groups after the experiment are likely to be the result of the different treatments assigned to each group (e.g., the influence of a violent versus a nonviolent video game).

After the game is played in experiments on the effects of violent versus nonviolent video games, aggression is measured. Aggression is any behavior intended to harm another individual who wants to avoid the harm. Note that aggression is different than violence, which involves extreme physical actions intended to injure or kill another individual. Obviously it is not ethical to

[1]Anderson, C. A., & Bushman, B. J. (2002). Media violence and societal violence. *Science, 295*, 2377–2378.

[2]Anderson, C. A., Shibuya, A., Ihori, N., *Swing, E. L., Bushman, B. J., Sakamoto, A., Rothstein, H. R., Saleem, M., & *Barlett, C. P. (2010). Violent video game effects on aggression, empathy, and prosocial behavior in Eastern and Western countries: A meta-analytic review. *Psychological Bulletin, 136(2)*, 151–173.

[3]Bushman, B. J., & Huesmann, L. R. (2006). Short-term and long-term effects of violent media on aggression in children and adults. *Archives of Pediatrics & Adolescent Medicine, 160*, 348–352.

study violence in experimental studies, so researchers use less intense measures of aggression, such as delivering electric shocks or loud, unpleasant noise blasts through headphones. In our lab we use a mixture of unpleasant noises such as fingernails scratching a chalkboard, dentist drills, and sirens, delivered up to 105 decibels—about the same level as a fire alarm. Other measures of laboratory aggression include giving a partner who hates spicy food hot sauce to eat, or deciding how long a partner must keep his or her arm in icy water.

Research has found very high levels of convergence across a wide range of different laboratory aggression measures.[4] If violent and nonviolent video game players are equally aggressive before they play the game, but violent game players are more aggressive afterwards, only two factors could have caused the difference in aggression: (1) the nature of the game they played, or (2) a random fluke. Researchers conduct stringent statistical tests to minimize the likelihood of random flukes.

There is also considerable evidence to suggest that laboratory measures of aggression are valid indicators of aggression outside the laboratory. Research has shown that the level of aggression displayed on these laboratory measures is higher for male adolescent delinquents with a history of violence than for male adolescent delinquents with no history of violence,[5] and for young male offenders in a maximum security penal facility than for young male college students.[6] The level of laboratory measures of physical aggression also has been found to be higher for high school students nominated by their counselors to be aggressive than for high school students nominated by their counselors to be nonaggressive,[7] and for third-graders nominated by their peers to be aggressive than for third-graders nominated by their peers to be nonaggressive.[8]

Research has also shown that laboratory measures of aggression and real-world measures of aggression and violence are influenced in similar ways by

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[4]Carlson, M., Marcus-Newhall, A., & Miller, N. (1989). Evidence for a general construct of aggression. *Personality and Social Psychology Bulletin, 15*, 377–389.

[5]Hartman, D. P. (1969). Influence of symbolically modeled instrumental aggression and pain cues on aggressive behavior. *Journal of Personality and Social Psychology, 11*, 280–288.

[6]Wolfe, B. M., & Baron, R. A. (1971). Laboratory aggression related to aggression in naturalistic social situations: Effects of an aggressive model on the behavior of college student and prisoner observers. *Psychonomic Science, 24*, 193–194.

[7]Shemberg, K. M., Leventhal, D. B., & Allman, L. (1968). Aggression machine performance and rated aggression. *Journal of Experimental Research in Personality, 3*, 117–119.

[8]Williams, J. E, Meyerson, L. J., Eron, L., & Semler, I. J. (1967). Peer-rated aggression and aggressive responses elicited in an experimental situation. *Child Development, 38*, 181–190.

situational variables (e.g., alcohol, provocation) and by individual difference variables (e.g., trait aggressiveness and sex).[9]

Overall, then, there is strong evidence that exposure to aggressive and violent media can cause an increase in aggressive behavior. What cannot be established is that exposure to aggressive and violent media causes actual gun violence.

Question. You discuss the issue of a universal ratings system in your testimony. Do you believe that parents are not sufficiently engaged in this issue to keep up with the U.S. ratings systems for movies, television and video games? Or do you believe the current U.S. systems are just overly-complicated and therefore should be streamlined into a universal system like what Europe has?

Answer. Both. Many parents are not sufficiently engaged in monitoring what media their children consume. Part of the problem is that most parents learn what is harmful to their children from the mass media, and the mass media are reluctant to admit that they are marketing a harmful product (much like the tobacco industry was reluctant to admit that cigarettes are harmful).[10] Only about 30% of parents of children 8–18 years old have media rules.[11] Moreover, the use of media rules by parents has decreased over time.[12] In addition, the U.S. rating system is like alphabet soup, with different letters used for different types of media (e.g., "R" for movies, "TV–MA" for television, "M" for video games). Many parents are confused by the ratings. In one study, for example, only 31% of parents knew what TV–Y meant the program was designed to be appropriate for all children, only 5% knew that "D" meant suggestive dialogue, and only 14% knew that FV had something to do with violence.[13] In addition, the U.S. ratings are assigned by the industry. In the Netherlands, where I am a professor in the summer, there is a universal rating system for TV, movies, and video games. There are 5 age-based ratings (3+, 7+, 12+, 16+, 18+), and 6 well-recognized symbols for potentially objectionable material (violence, sex, drugs, discrimination, fear, gambling), such as a fist for violence. Virtually all parents know what these ratings mean. Europeans

[9]Anderson, C. A., & Bushman, B. J. (1997). External validity of "trivial" experiments: The case of laboratory aggression. *Review of General Psychology, 1*, 19–41.

[10]Bushman, B. J., & Anderson, C. A. (2001). Media violence and the American public: Scientific facts versus media misinformation. *American Psychologist, 56*, 477–489.

[11]Kaiser Family Foundation (2010). *Generation M^2: Media in the lives of 8-to-18-year-olds.* Retrieved from `http://www.kff.org/entmedia/upload/8010.pdf`

[12]Kaiser Family Foundation (2006). *The media family: Electronic media in the lives of infants, toddlers, preschoolers, and their parents.* Retrieved from `http://www.kff.org/entmedia/upload/7500.pdf`

[13]Kaiser Family Foundation. (2001). *Parents and the V-chip 2001: How parents feel about TV, the TV ratings system, and the V-chip.* Menlo Park, CA: Author.

are also far more sensitive to the presence of violence in media, which is something that U.S. media ratings tend to ignore.

Questions for the Record for Dr. Suresh—Mr. Aderholt

CLIMATE MODELING

Question. I am told that there are refereed, peer-reviewed publications showing that climate models over the past 35 years are running significantly warmer than the actual observations. This would raise serious questions for the Congress about how well the Earth's complex climate system is actually understood, with implications on the scientific basis for energy policy as well as for assessing how our national policy might realistically impact the Earth's climate in a desirable way. What is your agency doing to better understand why the most widely-used climate models are not able to reproduce the actual climatic observations, particularly those made from space?

Answer. NSF is not aware of any peer-reviewed publications showing that climate models are systematically too warm over the past 35 years. To continuously improve the nation's ability to model climate, NSF supports researchers who examine the quality of climate model simulations using a wide of variety of observations, including comparison with satellite observations.

Question. What has NSF done to actively promote and solicit scientific investigations that are consistent with the evidence (of very modest climate change) yet which contradict the popular view that global warming is rapid, human-caused, and dangerous? What steps does your agency take to ensure that all expert perspectives, including those that might call into question popular theories, are considered in developing, executing, and assessing your agency's current climate change programs?

Answer. NSF accepts unsolicited proposals for research into the causes of climate variability and climate change, without regard for whether the hypothesized causes are natural or anthropogenic. Projects are supported on their scientific merit, that is, the appropriateness of the proposed methodology to answer a question or test a hypothesis.

Question. What has NSF done to ensure that the scientists who are involved in measuring the agreement between the models and the data had no role in developing the models?

Answer. NSF funds a number of research projects that assess the agreement between models and observations, and much of this research is done by university researchers not involved in model development. NSF recently made several awards to examine the quality of the climate model simulations

prepared for the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment report. NSF also supports university researchers who are not involved in model development to perform their own simulations to assess the model's ability to simulate a particular process. The results can provide important input to developers for improving the models.

Question. What metrics can you present to demonstrate that the development, execution, and assessment of your climate change programs includes all expert perspectives, including those that may not agree with or support the most popular climate system theories? (This is the "red team" concept commonly used in industry and government for expensive programs.)

Answer. NSF receives and supports proposals to conduct research, including the development or evaluation of climate models. NSF does not survey or track the views of scientists regarding climate change. Through its merit review process, NSF seeks input from members of the scientific community based on their expertise relevant to the topic. Reviewers are asked to objectively evaluate proposals utilizing the two merit review criteria established by the National Science Board: intellectual merit and broader impacts. There is no attempt to screen potential reviewers or panelists to select those who do or do not hold particular viewpoints.

REALIGNMENT

Question. Your testimony indicates that several of your directorates have been merged and consolidated since September 2012. How has this changed enabled the NSF to prepare for the impact of sequestration? Was it done to help ease the financial burden of sequestration or was it done for other purposes?

Answer. NSF embraces decisions that bring about increased operational efficiency. Periodically, we review organizational structures to determine if the science or our own internal pressures dictate a more desirable organizational structure. Those decisions are balanced with the productivity costs that accompany any organizational change. Where the benefits and scientific fit outweigh the productivity costs, we work to realize the benefits. It was in this vein that NSF undertook a review of the units reporting to the Office of the Director. That review resulted in the recommendation to realign several offices last fall. The former Office of International Science and Engineering was combined with the Office of Integrative Activities to form the Office of International and Integrative Activities. The former Office of Polar Programs was combined with the Geosciences to form the Polar Division. Finally, the Office of Cyber-infrastructure was combined with the Computer and

Information Science and Engineering Directorate to form the Division of Advanced Cyberinfrastructure.

GRADUATE RESEARCH OPPORTUNITIES WORLDWIDE (GROW) PROGRAM

Question. Recently, this subcommittee heard testimony from the Director of the FBI that discussed the threat of foreign cyber-spying on U.S. universities, corporations, and federal agencies for newly developed technologies. With the GROW Program, I understand that we are partnering with eight partner countries to further science research. However, how do we ensure that technologies and other discoveries that are being researched in partnership with other countries will be safeguarded in GROW and other similar endeavors?

Answer. GROW is administered through NSF's Graduate Research Fellowship program and is subject to the same laws and guidelines for research conduct as other federal grant programs. Specifically, "... all academic and research activities carried out in or outside the US comply with the laws or regulations of the US and/or of the foreign country in which the academic and/or research activities are conducted. These include appropriate human subject, animal welfare, copyright and intellectual property protection, and other regulations or laws, as appropriate. All academic and research activities should be coordinated with the appropriate US and foreign government authorities, and necessary licenses, permits, or approvals must be obtained prior to undertaking the proposed activities."[14]

These safeguards, which apply to NSF-supported principal investigators, graduate students, and other award recipients working in the United States or abroad, help mitigate the concerns raised in the question. In addition, NSF does not support the conduct of classified research. Also, NSF supported research is basic research that is pre-commercial and published in the open scientific literature.

QUESTIONS FOR THE RECORD FOR DR. SURESH—MR. SERRANO

LATINOS AND THE SCIENCES

NSF has specialized undergraduate education programs for Blacks and Native Americans, but not specialized programs for Latinos. Since fiscal year 2010, there has been appropriations report language directing the NSF to address the needs of HSIs. The House passed bill for Fiscal year 2013 repeated report language that stated: "The Committee has previously asked NSF to consider

[14]National Science Foundation, Directorate for Education and Human Resources Division of Graduate Education. (2011) *Graduate Research Fellowship Program: Administrative Guide for Fellows and Coordinating Officials.* Arlington, VA.

the concept of creating a program within EHR to focus on Hispanic Serving Institutions (HSIs). NSF shall provide to the Committees on Appropriations a report outlining how the needs of HSIs will be addressed in fiscal year 2013 and any plans to establish an HSI-focused program in fiscal year 2014. This report shall be submitted no later than 120 days after the enactment of this Act." Although the House bill became stuck in the Senate, there are still several years of pending instructions in this area. While I appreciate the efforts NSF is making in expanding opportunities to underrepresented minorities, including through the establishment of a new program in this year's budget?, I am troubled that NSF has not established a dedicated Hispanic Serving Institutions- Undergraduate program. Latinos are now the largest minority group in the United States, and are severely underrepresented in the STEM fields. More importantly, Congressional instruction was very clear in this regard.

Question. Are steps being planned to follow the previous language on this issue?

Answer. NSF recognizes that Hispanics are the largest and fastest-growing minority group in the nation; the U.S. Hispanic population grew four times faster than the total U.S. population between 2000 and 2010. To ascertain the support provided to Hispanic Serving Institutions, NSF conducted an internal portfolio analysis to identify the educational efforts that focus on the needs of HSIs. This analysis showed that over the past five years, NSF investments in HSIs have increased considerably and exceeded that of other minority serving institutions with dedicated programs, such as Historically Black Colleges and Universities (HBCUs) and Tribal Colleges and Universities (TCUs). In FY 2012, investments in HSIs reached more than 70 colleges and universities, and 66 percent of NSF's FY 2012 funding to HSIs came from the Research and Related Activities category. Given this significant level of investment, NSF plans to continue activities that are successfully meeting the needs of HSIs, including encouraging proposals from HSIs to appropriate, existing NSF programs that focus on improving undergraduate education and/or express a commitment to broadening participation of groups underrepresented in STEM, and continuing the emphasis within NSF programs such as Louis Stokes Alliances for Minority Participation (LSAMP) and Advanced Technological Education (ATE) to support community colleges. NSF will focus on areas of critical need, such as capacity building at community colleges, particularly those with a high level of Hispanic student enrollment, and evaluation of the overall impact of NSF-wide HSI activities to inform future actions and ascertain the need for additional HSI specific efforts in FY 2014 and beyond. NSF will use data on HSI community college success rates and other relevant

findings to better target those institutions and augment the investment's overall impact, which will be essential to future planning.

DIVERSITY IN THE SCIENCES

Statistics show that Latinos and Blacks are under-represented in the science, technology, engineering, and math (STEM) fields—sciences, technology, engineering, and mathematics. The latest National Science Foundation statistics available show that while Blacks represent more than 12% of the population, they only represent 8.2% of bachelor's degree recipients in the sciences in 2009. In addition, Latinos now represent more than 15% of the US population, but only 8.6% of students graduating with a bachelor's degree in the sciences in 2009. In this vein, last year, the American Association for the Advancement of Science (AAAS) issued a report called "Measuring Diversity: An Evaluation Guide for STEM Graduate Program Leaders," based on work with NSF's Alliance for Graduate Education and the Professoriate (AGEP). The report offers a framework and tools for assessing the strengths and weaknesses of graduate programs. Statistics continue to show that Blacks and Latinos are significantly under-represented in the sciences and other STEM fields.

Question. How has the Administration approached this problem? Does the Administration have a government-wide policy in place to increase minority participation in these fields? Does the National Science and Technology Council's (NSTC) Committee on STEM plan to specifically address this issue?

Answer. The February 2012 progress report of the National Science and Technology Council Committee on STEM Education (CoSTEM) indicated that the Administration identified "serving groups traditionally under-represented in STEM fields" as one of four priority areas for interagency coordination. The primary objective is to provide higher quality education opportunities to individuals from under-represented groups for the purpose of increasing representation of under-represented groups in STEM fields. The progress report also suggested that the following criteria for investments in STEM education of under-represented groups should be considered: design investments with input from under-represented groups; ensure that investments draw upon the interests, knowledge, practices, and culturally relevant STEM experiences of under-represented groups; and support investments that build capacity and sustained relationships between participants and STEM partners. The five-year Federal STEM Education Strategic Plan that is under development will further delineate the approach with a priority area roadmap of the near, mid- and long-term goals and related metrics and outcomes to facilitate

federal coordination for increasing the participation and representation of under-represented groups in STEM fields. Additionally, a goal of the Administration's proposed reorganization of STEM education programs is increasing opportunities and participation for individuals from underrepresented groups in STEM fields.

Question. Furthermore, does the NSF factor in the framework set forth in the "Measuring Diversity" report when awarding grants to graduate institutions?

Answer. The Measuring Diversity report continues to be a useful guide for conceptualizing broadening participation in graduate education as well as a tool to help graduate institutions improve the quality of data collected and make meaningful use of participation and performance data. When appropriate, proposers to NSF programs are asked to provide baseline data and evaluation plans with measurable metrics. The Measuring Diversity report was intended as a tool for proposers to NSF programs to develop relevant graduate education proposals, particularly for underrepresented groups in STEM as well as include well-designed data collection and project evaluation. The Measuring Diversity report provides a framework to inform the review of this aspect of proposals and annual reports from funded projects.

Attachment 1: List of Programs Affected by STEM Reorganization

FY 2012 Inventory of STEM Programs

Program	Program Type
Agriculture	
Consolidations (Funding Redirected Outside of Agency)	
Agriculture in the Classroom	Engagement
AITC Secondary Postsecondary Agriculture Education Challenge Grants (SPECA)	Engagement
Food and Agricultural Sciences National Needs Graduate and Postgraduate Fellowship Grant Program	Fellowship/ Scholarship
Higher Education Challenge Grants (HEC)	Undergraduate Education
Higher Education Multicultural Scholars Program (MSP)	Fellowship/ Scholarship
Women and Minorities in Science, Technology, Engineering and Mathematics Fields Program (WAMS)	Fellowship/ Scholarship
Internal Consolidations/Eliminations (Funding Remains within the Agency)	
Distance Education Grants for Institutions of Higher Education in Insular Areas (DEG)	Fellowship/ Scholarship
Resident Instruction Grants Program for Institutions of Higher Education in Insular Areas	Fellowship/ Scholarship
Existing Programs Maintained (Not Consolidated)	
1890 Facilities Grant Program	Minority Serving Institutions
1890 Institutions Capacity Building Grants Program: Extension	Minority Serving Institutions
1890 Institutions Capacity Building Grants Program: Teaching	Minority Serving Institutions
4-H Science, 4-H Youth Development Program	Engagement
AgDiscovery	Fellowship/ Scholarship
Alaska Native-Serving and Native Hawaiian-Serving Institutions Education Competitive Grants Program	Minority Serving Institutions
Hispanic-Serving Institutions Education Grants Program	Minority Serving Institutions
NIFA Fellowship Grants Program	Minority Serving Institutions
New Programs	
Insular Programs	None
Commerce (includes National Oceanic and Atmospheric Administration)	
Consolidations (Funding Redirected Outside of Agency)	
Competitive Education Grants (including Environmental Literacy Grants)	STEM Instruction
Dr. Nancy Foster Scholarship Program	Fellowship/ Scholarship
National Sea Grant College Program*	STEM Instruction
NIST Summer Institute for Middle School Teachers	STEM Instruction
NOAA Office of Ocean Exploration and Research (Education Only)	Engagement
NOAA Teacher at Sea Program	STEM Instruction
Internal Consolidations/Eliminations (Funding Remains within the Agency)	

Coral Reef Conservation Program	Engagement
National Estuarine Research Reserve System	STEM Instruction
NOAA Bay Watershed Education and Training (B-WET)	STEM Instruction
NOAA Fisheries Education Program	STEM Instruction
Satellite and Information Service	Engagement
Existing Programs Maintained (Not Consolidated)	
Educational Partnership Program with Minority Serving Institutions	Minority Serving Institutions
Ernest F. Hollings Undergraduate Scholarship Program	Fellowship/ Scholarship
STEM Pipeline for the Next Generation Scientists and Engineers.	Fellowship/ Scholarship
Summer Undergraduate Research Fellowship (SURF)	Fellowship/ Scholarship

* $4M in activities within the National Sea Grant College Program (including funding for the Sea Grant Knauss Policy Fellowships, Sea Grant/NMFS Graduate Fellowship Program, and STEM instruction) was redirected outside of the agency.

Defense	
Consolidations (Funding Redirected Outside of Agency)	
DoD STARBASE Program	Engagement
Iridescent Learning	Engagement
National Defense Education Program (NDEP) K-12 component	Engagement
National Science Center (NSC)	Engagement
Uniformed Services University of the Health Sciences (USUHS)	Fellowship/ Scholarship
University Laboratory Initiative (ULI)	Fellowship/ Scholarship
Existing Programs Maintained (Not Consolidated)	
Army Educational Outreach Program (AEOP)	STEM Instruction
Awards to Stimulate and Support Undergraduate Research Experiences (ASSURE)	Fellowship/ Scholarship
Historically Black Colleges and Universities/Minority Institutions Research and Education Partnership	Minority Serving Institutions
National Defense Education Program (NDEP) Science, Mathematics And Research for Transformation (SMART)	Fellowship/ Scholarship
National Defense Science and Engineering Graduate (NDSEG) Fellowship Program	Fellowship/ Scholarship
Navy - Science and Engineering Apprenticeship Program (SEAP)	Engagement
SeaPerch	Engagement
Stokes Educational Scholarship Program	Fellowship/ Scholarship
The Naval Research Enterprise Intern Program (NREIP)	Engagement
University NanoSatellite Program	Engagement
Education	
Internal Consolidations/Eliminations (Funding Remains within the Agency)	
Improving Teacher Quality State Grants/Effective Teacher and Leader State Grants Set Aside	STEM Instruction
Teacher Incentive Fund	STEM Instruction
Existing Programs Maintained (Not Consolidated)	
Developing Hispanic Serving Institutions STEM and articulation programs	Minority Serving Institutions
Graduate Assistance in Areas of National Need (GAANN)	Fellowship/ Scholarship
High School Longitudinal Study of 2009	None

Investing in Innovation	STEM Instruction
Mathematics and Science Partnerships/Effective Teaching and Learning for a Complete Education	STEM Instruction
Minority Science and Engineering Improvement Program	Minority Serving Institutions
Research in Special Education	None
Research, Development, and Dissemination	None
Strengthening Predominantly Black Institutions	Minority Serving Institutions
Teacher Loan Forgiveness	STEM Instruction
Upward Bound Math and Science Program	STEM Instruction
New Programs	
Fund for the Improvement of Education (FIE): Math Inititative	None
STEM Innovation	STEM Instruction
Energy	
Consolidations (Funding Redirected Outside of Agency)	
American Chemical Society Summer School in Nuclear and Radiochemistry	Engagement
Computational Science Graduate Fellowship	Fellowship/ Scholarship
Global Change Education Program	Fellowship/ Scholarship
Graduate Automotive Technology Education	Fellowship/ Scholarship
National Undergraduate Fellowship Program in Plasma Physics and Fusion Energy Sciences	Fellowship/ Scholarship
Plasma/Fusion Science Educator Programs	STEM Instruction
QuarkNet	STEM Instruction
Wind for Schools	Engagement
Existing Programs Maintained (Not Consolidated)	
Advanced Vehicle Competitions	Engagement
Community College Internships (formerly Community College Institute of Science and Technology)	None
Visiting Faculty Program (formerly Faculty and Student Teams)	Engagement
HBCU Mathematics, Science & Technology, Engineering and Research Workforce Development Program	Minority Serving Institutions
Industrial Assessment Centers	Engagement
Minority Educational Institution Student Partnership Program	Minority Serving Institutions
Minority University Research Associates Program (MURA)	Minority Serving Institutions
National Science Bowl	Engagement
Science Undergraduate Laboratory Internships	Engagement
Solar Decathlon	Engagement
Special Recuitment Programs/Mickey Leland Fellowship	Engagement
New Programs	
Office of Science Graduate Fellowship (SCGF) program	Engagement
Environmental Protection Agency	

Consolidations (Funding Redirected Outside of Agency)	
Greater Research Opportunities (GRO) Fellowships for Undergraduate Environmental Study	Fellowship/ Scholarship
Science to Achieve Results Graduate Fellowship Program	Fellowship/ Scholarship
Internal Consolidations/Eliminations (Funding Remains within the Agency)	
Environmental Education Grants	Engagement
National Environmental Education and Training Partnership	Engagement
Existing Programs Maintained (Not Consolidated)	
Cooperative Training Partnership in Environmental Sciences Research	Fellowship/ Scholarship
P3-People, Prosperity & the Planet-Award: A National Student Design Competition for Sustainability	Engagement
University of Cincinnati/EPA Research Training Grant	Fellowship/ Scholarship
Health and Human Services (Includes National Institutes of Health)	
Consolidations (Funding Redirected Outside of Agency)	
Clinical Research Training Program	Fellowship/ Scholarship
Curriculum Supplement Series	STEM Instruction
NIAID Science Education Awards	STEM Instruction
NINDS Diversity Research Education Grants in Neuroscience	Fellowship/ Scholarship
NLM Institutional Grants for Research Training in Biomedical Informatics	Fellowship/ Scholarship
OD Science Education Partnership Award	STEM Instruction
Office of Science Education K-12 Program	Engagement
Public Health Traineeship	Fellowship/ Scholarship
Science Education Drug Abuse Partnership Award	Engagement
Short Term Educational Experiences for Research (STEER) in the Environmental health Sciences for Undergraduates and High School Students	Fellowship/ Scholarship
Internal Consolidations/Eliminations (Funding Remains within the Agency)	
Health Careers Opportunity Program	Engagement
Short Courses on Mathematical, Statistical, and Computational Tools for Studying Biological Systems	Engagement
Existing Programs Maintained (Not Consolidated)	
Bridges to the Baccalaureate Program	Fellowship/ Scholarship
Initiative for Maximizing Student Development	Engagement
MARC U-STAR NRSA Program	Minority Serving Institutions
Mathematics and Science Cognition and Learning (MSCL) Program	Engagement
National Cancer Institute Cancer Education and Career Development Program	Fellowship/ Scholarship
RISE (Research Initiative for Scientific Enhancement)	Minority Serving Institutions
Ruth L. Kirschstein National Research Service Award Institutional Research Training Grants (T32, T35)	Fellowship/ Scholarship
Ruth L. Kirschstein NRSA for Individual Predoctoral Fellows, including Underrepresented Racial/Ethnic Groups,Students from Disadvantaged Backgrounds, and Predoctoral Students with Disabilities	Fellowship/ Scholarship
Short Courses in Population Reseach (Education Programs for Population Research R25)	Engagement
Short-Term Research Education Program to Increase Diversity in Health-Related	Engagement

Research	
Student Intramural Research Training Award Program	
Summer Institute for Training in Biostatistics	Engagement
Undergraduate Scholarship Program for Individuals from Disadvantaged Backgrounds	Fellowship/ Scholarship
New Programs	
Medical Research Scholars Program (MRSP)	Fellowship/ Scholarship
Homeland Security	
Consolidations (Funding Redirected Outside of Agency)	
Homeland Security STEM Career Development Grant Program	Fellowship/ Scholarship
Existing Programs Maintained (Not Consolidated)	
National Nuclear Forensics Expertise Development Program	Fellowship/ Scholarship
Scientific Leadership Awards Program	Minority Serving Institutions
Interior	
Existing Programs Maintained (Not Consolidated)	
Conservation and Land Management Internship Program	Engagement
EDMAP	Engagement
George Melendez Wright Climate Change Youth Initiative	Fellowship/ Scholarship
Geoscientists-in-the-Parks Program	Fellowship/ Scholarship
National Aeronautics and Space Administration	
Consolidations (Funding Redirected Outside of Agency)	
Aeronautics Academy	Fellowship/ Scholarship
Aeronautics Content - Smart Skies/Product Content Upgrade	Engagement
Aeronautics Scholarship	Fellowship/ Scholarship
Aqua	Engagement
Astrophysics Forum	Engagement
Aura	Engagement
Cassini	STEM Instruction
Chandra	STEM Instruction
DAWN	STEM Instruction
Design Competitions	Engagement
Earth Science E/PO Forum	Engagement
eEducation Small Projects/Central Operation of Resources for Educators (CORE)	Engagement
EPOESS	Engagement
GCCE - Global Climate Change Education	STEM Instruction
GRAIL	Engagement
GSRP - Graduate Student Researchers Program	Fellowship/ Scholarship
Heliophysics E/PO Forum	Engagement
HEOMD-NASA's Beginning Engineering, Science and Technology (BEST) Students (NBS)	Engagement
HST	STEM Instruction
Innovation in Higher Education STEM Education	Fellowship/ Scholarship

INSPIRE - Interdisciplinary National Science Program Incorporating Research and Education Experience	Engagement
JPFP - Jenkins Pre-Doctoral Fellowship Program	Fellowship/ Scholarship
Juno	Engagement
LDCM	Engagement
LEARN - Learning Environment and Research Network	STEM Instruction
Mars E/PO Formal Ed	Engagement
Mars E/PO Informal Ed	Engagement
MESSENGER	Engagement
NAS - NASA Aerospace Scholars	Engagement
NES - NASA Explorer Schools	Engagement
Planetary Science E/PO Forum	Engagement
Reduced Gravity Student Flight Opportunity Project	Engagement
SEMAA - Science Engineering Mathematics and Aerospace Academy/FIRST Buckeye	Engagement
SOFIA (Stratospheric Observatory for Infrared Astronomy) Education and Public Outreach	STEM Instruction
SOI - Summer of Innovation/NASA IV&V Engineering Apprenticeship Program	Engagement
Spaceward Bound	Engagement
USRP - Undergraduate Student Research Project	Engagement
Internal Consolidations/Eliminations (Funding Remains within the Agency)	
AESP - Aerospace Education Services Project	Engagement
CEP - Career Exploration Project	Engagement
Curriculum Improvement Partnership Award for the Integration of Research into the Undergraduate Curriculum (CIPAIR)	Minority Serving Institutions
EFP - Education Flight Projects	Engagement
ESMD Space Grant Project	Fellowship/ Scholarship
HEOMD-Goldstone Apple Valley Radio Telescope (GAVRT) Project	None
HEOMD-University Student Launch Initiative	Engagement
Informal STEM Education	Engagement
Innovation in Aeronautics Instruction Competition	None
LARSS - NASA Langley Aerospace Research Summer Scholars Program	Fellowship/ Scholarship
LERCIP - Lewis Educational Research Collaborative Internship Project (College)	Fellowship/ Scholarship
LTP - Learning Technologies Project	Engagement
MUST - Motivating Undergraduates in Science and Technology	Fellowship/ Scholarship
NETS - NASA Education Technologies Services	Engagement
NSBRI Higher Education Activities - National Space Biomedical Research Institute	Fellowship/ Scholarship
Research Cluster	None
SEED - Systems Engineering Educational Discovery	Engagement
Existing Programs Maintained (Not Consolidated)	
GLOBE Program	Engagement
Space Grant - National Space Grant College and Fellowship Program	Engagement
Space Technology Research Fellowships	Fellowship/ Scholarship

MUREP (4 STEM programs in FY 2012 Inventory: MUREP Small Projects, NASA Science and Technology Institute for Minority Institutions, NASA Tribal College and University Project, University Research Centers)	Minority Serving Institutions
New Programs	
STEM Education & Accountability Project*	

*NASA's STEM Education & Accountability Project will take on a new structure to ensure the continuation of the most effective functions of its engagement and STEM instruction activities.

National Science Foundation

Internal Consolidations/Eliminations (Funding Remains within the Agency)	
Climate Change Education (CCE)	Undergraduate Education
Computing Education for the 21st Century (CE21)	Undergraduate Education
Cyberinfrastructure Training, Education, Advancement, and Mentoring for Our 21st Century Workforce (CI-TEAM)	STEM Instruction
Engineering Education (EE)	Undergraduate Education
Geoscience Education	Undergraduate Education
Geoscience Teacher Training (GEO-Teach)	Undergraduate Education
Global Learning and Observations to Benefit the Environment (GLOBE)	Engagement
Graduate Teaching Fellows in K-12 Education (GK-12)	STEM Instruction
Integrative Graduate Education and Research Traineeship (IGERT) Program	Fellowship/ Scholarship
Math and Science Partnership (MSP)	STEM Instruction
Nanotechnology Undergraduate Education in Engineering	Undergraduate Education
Opportunities for Enhancing Diversity in the Geosciences	Undergraduate Education
Research in Disabilities Education (RDE)	Fellowship/ Scholarship
Research on Gender in Science and Engineering (GSE)	Engagement
Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP)	Undergraduate Education
Transforming Undergraduate Biology Education (TUBE)	Engagement
Transforming Undergrad Education in STEM (TUES)	Undergraduate Education
Widening Implementation and Demonstration of Evidence-based Reforms (WIDER)	Undergraduate Education
Existing Programs Maintained (Not Consolidated)	
Advanced Informal STEM Learning (AISL), formerly Informal Science Education (ISE)	Engagement
Advanced Technological Education (ATE)	STEM Instruction
Alliances for Graduate Education and the Professoriate (AGEP)	Fellowship/ Scholarship
Centers for Ocean Sciences Education Excellence	STEM Instruction
Discovery Research K-12 (DR-K12)	STEM Instruction
East Asia & Pacific Summer Institutes for U.S. Graduate Students (EAPSI)	Fellowship/ Scholarship
Enhancing the Mathematical Sciences Workforce in the 21st Century (EMSW21)	Fellowship/ Scholarship
Excellence Awards in Science and Engineering (EASE)	STEM Instruction
Federal Cyber Service: Scholarship for Service (SFS)	Fellowship/ Scholarship

Graduate Research Fellowship Program (GRFP)	Fellowship/ Scholarship
Historically Black Colleges and Universities Undergraduate Program (HBCU-UP)	Minority Serving Institutions
Innovative Technology Experiences for Students and Teachers (ITEST)	STEM Instruction
International Research Experiences for Students (IRES)	Engagement
Louis Stokes Alliances for Minority Participation (LSAMP)	Fellowship/ Scholarship
NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM)	Fellowship/ Scholarship
Research Experiences for Teachers (RET) in Engineering and Computer Science	STEM Instruction
Research Experiences for Undergraduates (REU)	None
Research on Education and Learning (REAL), formerly Research and Evaluation on Education in Science and Engineering (REESE)	STEM Instruction
Robert Noyce Scholarship (Noyce) Program	STEM Instruction
Tribal Colleges and Universities Program (TCUP)	Minority Serving Institutions
New Programs	
Catalyzing Advances in Undergraduate STEM Education (CAUSE)	Undergraduate Education
STEM-C Partnerships	STEM Instruction
NSF Research Traineeships (NRT)	None
Nuclear Regulatory Commission	
Consolidations (Funding Redirected Outside of Agency)	
Integrated University Program*	Fellowship/ Scholarship
Nuclear Education Curriculum Development Program*	Undergraduate Education
Existing Programs Maintained (Not Consolidated)	
Minority Serving Institutions Program (MSIP)	Minority Serving Institutions
*Funding was retained at the agency due to the nature of the program's funding mechanism (it is largely funded through a fee). Once 2014 funding is final, funds would be transferred to NSF through a mechanism to be determined for undergraduate and graduate programs.	
Smithsonian Institution	
New Programs	
STEM Informal Education and Instruction	Engagement
Transportation	
Existing Programs Maintained (Not Consolidated)	
Air Transportation Centers of Excellence	None
Dwight David Eisenhower Transportation Fellowship Program	Fellowship/ Scholarship
Garrett A. Morgan Technology and Transportation Education Program	Engagement
National Summer Transportation Institute Program (STI)	Engagement
Summer Transportation Institute Program for Diverse Groups (STIPDG)	Engagement
University Transportation Centers Program	None

Agency Summary	N
Consolidations (Funding Redirected Outside of Agency)	**78**
Agriculture	6
Commerce	6
Defense	6
Energy	8
Environmental Protection Agency	2
Health and Human Services	10
Homeland Security	1
National Aeronautics and Space Administration	37
Nuclear Regulatory Commission	2
Internal Consolidations (Funding Remains with the Agency)	**48**
Agriculture	2
Commerce	5
Education	2
Environmental Protection Agency	2
Health and Human Services	2
National Aeronautics and Space Administration	17
National Science Foundation	18
Existing Programs Maintained (Not Consolidated) and New Programs	**110**
Agriculture	9
Commerce	4
Defense	10
Education	13
Energy	12
Environmental Protection Agency	3
Health and Human Services	14
Homeland Security	2
Interior	4
National Aeronautics and Space Administration	8
National Science Foundation	23
Nuclear Regulatory Commission	1
Smithsonian	1
Transportation	6

WITNESSES

	Page
Bolden, C. F., Jr	1
Bushman, Dr. B. J	167
Martin, P. K	119
Suresh, Subra	167

INDEX

National Aeronautics and Space Administration

Maj. Gen. Charles F. Bolden, Jr., USMC (ret.), Administrator

Page

Arc-Jet facility 40–42
Arecibo Observatory 28–31
Center for the Advancement of Science in Space 15–16
Collaboration across agencies 17
Commercial crew 39–40, 46
Compliance with statutory authorities 12
Cooperation with China 44–48
Cost and schedule control 34–35
Destination of retired orbiters 42–43
Excess property 38–39
FY 2013 appropriations concerns 18–19
Flight Opportunities Program 25–26
Foreign espionage threat 11
Heavy list rocket and Multi-Purpose Crew Vehicle 20–21, 26
Independent external security review 11–12
Inspector general 44–45
Multi-year budget 26–28
NASA Space Act Agreements 31–34
NASA's education program 17–18
Opening statement:
- Gen. Bolden 4–10
- Mr. Fattah 3
- Mr. Wolf 1–4

Planetary science 21–25
Questions for the Record:
- Mr. Aderholt 95–117
- Mr. Culberson 92–95
- Mr. Serrano 117
- Mr. Wolf 49–92

Security controls at NASA centers 12–15
Sequestration implementation 35–36
Weather satellites 36–38
Working with a flat funding profile 43–44

National Aeronautics and Space Administration Office of Inspector General

The Honorable Paul K. Martin, Inspector General

Allegations of security violations at the Ames Research Center 132
Allegations of security violations at the Langley Research Center 132–139

Page
Budgeting for the Space Launch System 151–152
Conference expenditures 149
Cost and schedule performance 146–149
Cost savings from commercial spaceflight 146
Improving information technology security governance 144
Information on information technology security threats 153–154
James Webb Space Telescope 141–142
Laptop encryption at NASA centers 139–141
Maintaining leadership in space 150–151
NASA strategy for improved infrastructure management 134–135, 142–147
Opening statement:
Mr. Fattah 120
Mr. Martin 120–128
Mr. Wolf 119–120
Questions for the Record:
Mr. Aderholt 162–165
Mr. Wolf 156–162
RIF bans 149
Security allegations at the Ames Research Center 152–153
Threat to NASA form Chinese espionage 129–131, 154–155
Use of Space Act Agreements 146–147

National Science Foundation

Dr. Subra Suresh, Director

Allegations of wasteful grants 178–180
Correlation between media violence and aggressive behavior 219–221
Earthquake research 196–197
H1B visas 193–196
Impact of access to guns 224–225
International competition in research and development 185–186
Legacy of Dr. Suresh's tenure at NSF 188–191
Management of cooperative agreement 191–182
NSF's rapid response report on youth violence 199–201
Neuroscience 186–187
Opening statement:
Dr. Bushman 202–214
Dr. Suresh 168–177
Mr. Fattah 168
Mr. Wolf 167–168
Policy prescriptions for dealing with the impacts of violent media 230–231
Predicting violent behavior 221–223
QFRs for Dr. Bushman:
Mr. Aderholt 248–252
QFRs for Dr. Suresh:
Mr. Aderholt 252–254
Mr. Serrano 254–257
Mr. Wolf 232–248
Rampage shootings vs. more general violence in society 215–216
Reconciling conflicting scientific results on violent media 229
Relationship between violent behavior and suicide 225–227
Religion as a protective factor against violence 217–218
Retaining the results of federally funded research 180–185
Role of violent video games in recent mass shootings 227–228
Support for large research facilities 197–199

Page
Testing for a connection between violent media and violent behavior 228–229
Trends in violent crime and violent media 218–219