

COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS FOR 2015

HEARINGS BEFORE A SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS HOUSE OF REPRESENTATIVES ONE HUNDRED THIRTEENTH CONGRESS SECOND SESSION

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COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS FOR 2015

WEDNESDAY, APRIL 9, 2014.

DEPARTMENT OF COMMERCE

WITNESS

HON. PENNY PRITZKER, SECRETARY

Mr. WOLF. The hearing will come to order. Again, I apologize to my colleagues, too.

Our witness this afternoon is Secretary of Commerce Penny Pritzker who, quite frankly, I have been very impressed with since she has been appointed.

I want to welcome you, Madam Secretary. Good afternoon. Thank you for being here. You are here to testify about your fiscal year 2015 budget request.

The Department of Commerce budget request for fiscal year 2015 is \$8.75 billion. This amount is an increase of \$566 million above fiscal year 2014.

The Department has a broad array of responsibilities including activities impacting every American such as the weather service and the decennial census.

The Census Bureau is in the midst of planning for the next decennial. You are requesting an increase of \$266 million, a 28 percent increase for these planning efforts. The total cost of the 2010 census was \$13 billion.

The bureau has committed to a goal of holding the cost of the 2020 to no more than the per household cost of 2010. We would hope that you can commit to holding it to that amount or even less.

Thirteen billion is about the amount that it will cost to develop, launch, and operate one of the new weather satellite systems. This is a sizeable amount of money. We are looking to you and your leadership to make this the most accurate and cost-effective census ever and to ensure that all information collected from our citizens is appropriately safeguarded.

Likewise, maintaining and constantly improving the infrastructure necessary to forecast the weather for NOAA employees, to satellites in the sky, and radars on the ground is another costly but necessary endeavor. You are requesting \$2.057 billion to continue efforts to launch new weather satellites to maintain the existing satellite programs and supporting ground infrastructure.

Another topic we would like to discuss today is cyber security. You and I have had discussions about cyber security. I know you

are aware of the constant and persistent threats faced by nearly every American company and government computer systems.

Finally, we are going to ask you about repatriation or reshoring. We have discussed the need to reach out to American businesses to get them to bring their manufacturing and services back to the United States, back home.

I hope that you can enthusiastically embrace repatriation so we can once again say—and maybe my colleagues have seen this sign, maybe they have not. As you come up the northeast corridor and you come into Trenton, there is a sign on the bridge that says Trenton makes, the world takes. Trenton does not make very much anymore.

We would hope that we could have Trenton makes, the world takes line up in Trenton, but all through localities around this country.

I am also encouraged that the Department of Commerce is going to host a repatriation or reshoring summit on June 17th. This one-day event will be held in the Capitol Visitor Center and Secretary Pritzker has seized on the initiative.

Let me just say I do appreciate her attitude. She has been very open to ideas, and I want to thank you very much for your commitment to this. I know you have been actively engaged in getting some topnotch inspirational speakers for this event. Perhaps you can give us a flavor of what to expect at the repatriation summit.

As you know, our subcommittee included language and various directives in the Commerce, Justice, and Science bill for the last several years regarding reshoring economic security. Up until now, until you came, I think it has fallen on deaf ears. I will expect that we can make every effort to comply with the various reporting requirements related to this effort in the House report.

Today we will have a number of questions for you and you should anticipate more during the coming weeks as we review the budget in order to justify the request and help to identify areas where spending can be reduced with the least impact.

After you have given your statement, we will open up the hearing for Members' question.

But first I would like to recognize Mr. Fattah for any comments he may wish to make.

Mr. FATTAH. Let me thank the Chairman.

And let me welcome the Secretary.

And before I make my opening remarks, Mr. Chairman, I think you will join with me and I want to welcome former Chairman Walsh to the committee room. And I served under his leadership and it is good to see him again.

Madam Secretary, the IMF said yesterday that the United States economy was leading the recovery in the world and that even though other economies were weakened, the work that has been done by the very capable employees of your Department and all of its various agencies on behalf of this Administration, really this was an international, you know, acknowledgment of the great work that has been done over some 49 months of consistent and consecutive job creation.

We have seen upticks in manufacturing. We have seen throughout this effort after one of the worst recessions since the Great De-

pression that this economy, which is the world's largest, has been put back up on its feet.

And I really want to thank the employees of the Department of Commerce because across the board on a whole range of issues, they have just done an extraordinary job. And I know that it is a really—for you, I know that as you have gotten your arms around this, you have seen the collective mix of responsibilities.

And I want to say a few things. One is that the Manufacturing Extension Partnership is an extraordinary important priority and I am very happy to see that in the President's budget.

In your submission, you have asked for an increase in that. But the chairman has worked with me and we have increased it over the last years that we have been in these particular roles.

And I want to thank the chairman because he does not talk about manufacturing. He has actually done a great deal about it. And we have also put dollars into advanced manufacturing.

And then working with NIST, the efforts—you know, the world economic forum says that the United States is an innovation driven economy, so the work at NIST is critically important.

So we welcome you. I have had a chance to visit many of the agencies in the department, particularly the National Weather Service, and the severe weather events have cost our economy considerably.

We have had more severe weather events than at any point ever in our history. But the work of the National Weather Service has saved lives and it has been able to at least give fair warning and appropriate warning in areas of the country where it is needed.

So we welcome you today, look forward to continuing to work with you.

And I thank the chairman. I yield back.

Mr. WOLF. Thank you, Mr. Fattah.

Mrs. Lowey.

Mrs. LOWEY. Thank you very much. Thank you.

Need some innovation. Thank you, Chairman Wolf, Ranking Member Fattah.

I am so delighted to welcome you. We are indeed fortunate to have someone with your experience and your judgment in this position. And I look forward to getting to know you and making sure we continue to expand the important work that you have done in manufacturing. Well, you have done so many things.

Welcome, and thank you.

You come before us today with a fiscal year 2015 budget request of \$8.8 billion. This would fund important investments for the National Institute of Standards and Technology laboratories including advances in cyber security and disaster resilience as well as the development of NOAA's polar orbiting and geostationary weather satellites.

Year after year, we see a change in weather patterns where major weather events are more frequent, more severe. Investments in weather satellites help determine both the location and severity of forthcoming storms, helping local governments get information out to the public and often saving lives.

The budget also proposes \$497 million for the International Trade Administration, an eight percent increase over current fund-

ing, which would support interagency efforts to combat unfair trade practices and support businesses small and large by boosting U.S. exports.

I am particularly pleased to work with you in that regard because the economy is turning, but we still have to make sure that we help our businesses, especially our small businesses.

I am also pleased that the budget would significantly increase funding for the U.S. Patent and Trademark Office. With an increase of nearly 14 percent, our innovation economy depends on the ability of the Patent and Trademark Office to evaluate the merits of patent applications quickly and thoroughly. And this funding if granted would help accomplish these goals.

So I really am looking forward to working with you, and thank you for appearing before us. And we welcome our former colleague from New York. It is a pleasure to see you as well.

Mr. WOLF. Thank you. Thank you, Mrs. Lowey.

Pursuant to the authority granted in Section 191 of Title 2 of the United States Code in Clause 2M2 of House Rule 11, today's witness will be sworn in before testifying.

Yesterday we had a hearing, and I am going to send Members information on it, but maybe everything was not as accurate as was said. And so nobody knows who is going to control these Congresses in future years.

And this has nothing, absolutely, positively, categorically nothing to do with you. That is why I wanted to say this before so that you did not feel it was a reflection on you.

I think it is important that there be integrity when people come up to just tell the truth. There are a lot of times truth sometimes can be painful, but you just have to get it out. You know, had Nixon told the truth in 1974, maybe he would have finished his term, but he did not.

I am going to send Members information so you can see what I am talking about. And that is why we swear people in and I think it is a good policy to do that. But that has nothing to do with you, but I did not want you to feel, wow, he is swearing us in, is there a problem?

But if you would please rise and raise your right hand. We swear in all the government witnesses.

[Witness sworn.]

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

Madam Secretary, you may proceed and please summarize your remarks and proceed as you see appropriate.

HIGHLIGHTS OF THE DEPARTMENT OF COMMERCE BUDGET

Secretary PRITZKER. Thank you very much.

Chairman Wolf, Ranking Member Fattah, and Members of the subcommittee, thank you for this opportunity to discuss President Obama's fiscal year 2015 budget request for the Department of Commerce.

I want to begin, though, by thanking your chairman, Chairman Wolf, for your 34 years of service to your constituents and the American people. You have been an ardent supporter of funding for

science and technology, foreign direct investment, and a passionate advocate for international human rights.

I will miss working with you as will my colleagues at the Department of Commerce, but I have no doubt that you will continue to be a champion for the causes of freedom and justice in the years to come.

So thank you for all the time we have spent together and the guidance that you have given me.

The Department of Commerce budget request for \$8.8 billion reflects President Obama's commitment to support American businesses and create economic opportunity while building upon the important investments that Congress enacted in fiscal year 2014.

As you may know, the department rolled out its priorities in our strategic plan called the "Open for Business Agenda." The budget reflects our priorities in several ways.

First, we want to build on four consecutive record-breaking years of American exports and the trends in rising business investment in the United States.

We propose that the International Trade Administration receive an eight percent increase which will bolster our work to support current and potential exporters, boost inbound investment through our highly effective SelectUSA program, and strengthen trade enforcement.

I should also note that 2015 will conclude the biggest element of the President's export control reform initiative which strengthens our national security and allows for more trade with our allies.

Second, we will continue to support American innovation. The Commerce Department is becoming known as the department of innovation. Over the past few years, we have laid down more than 100,000 miles of broadband, bringing more opportunity to businesses and communities across the country. We have also reduced the patent application backlog, although we still have more work to do.

To continue driving innovation, the budget includes increased funding for research at bureaus such as the National Institute of Standards and Technology (NIST). As you know, NIST attracts private sector partners to collaborate with us in areas ranging from advanced manufacturing to cyber security.

Looking forward, we will expand efforts to help small manufacturers adopt new technologies and increase their competitiveness.

In addition, the budget reflects the President's call for the National Network of Manufacturing Innovation (NNMI), a powerful model focused on pre-competitive research and scale up risk which already has bipartisan support in the House and the Senate.

We will also drive innovation through regional capacity building, continued support for minority-owned business, and both executive and legislative efforts to continue strengthening our patent system, an issue that Congress is currently working to address.

Third, we will do more to unleash the potential of data. The budget proposes a significant increase to prepare an effective and efficient 2020 census. We have embarked on an aggressive research and testing program that will help us identify ways to make it easier for people to respond to the census.

We will consistently review the benchmarks of this program to ensure we are able to meet our goals. As you know, business and government leaders across the country use this crucial data to make decisions about growth and hiring.

Also, I recently announced that we will partner with the private sector to make more NOAA data available, accessible, and useable for entrepreneurs and the public. The budget supports this effort into fiscal year 2015.

Fourth, we will gather and act on environmental intelligence. The budget includes \$2 billion for satellites which provide weather and climate data to protect lives and property. These funds will also help businesses and communities adapt to a changing planet.

I should note that these satellite programs are currently on schedule and on budget thanks to our rigorous monitoring and management efforts.

The budget also includes \$519 million for our National Ocean Service (NOS) which improves the resilience of our coasts as well as \$917 million for our National Marine Fisheries Service (NMFS).

In closing, as a former business leader, I strongly believe that this budget reflects wise targeted investments of taxpayer dollars and investments that will be highly valued by the Commerce Department's stakeholders.

So I look forward to answering your questions and achieving the important vision laid out in our department's strategic plan.

[The information follows:]

**WRITTEN TESTIMONY BY SECRETARY PENNY PRITZKER
U.S. DEPARTMENT OF COMMERCE
FISCAL YEAR 2015 BUDGET REQUEST**

Chairman Wolf, Ranking Member Fattah, and members of the Subcommittee, thank you for this opportunity to discuss with you President Obama's Fiscal Year 2015 (FY15) budget request for the Department of Commerce. The investments included in the FY15 budget request build upon the important investments you enacted in FY14 and I am grateful for your support.

Our FY15 budget requests \$8.8 billion, a seven percent increase over FY 2014. This budget supports the Department's "Open for Business Agenda" by promoting trade and investment; spurring innovation; fueling our data-driven economy; and producing environmental intelligence. Investing in these areas builds on President Obama's vision for creating economic opportunity for all Americans. This Budget will help drive economic growth and job creation and reflects his confidence in the Department's ability to help businesses grow, compete, and innovate as the voice of business in the Administration.

The President's vision for creating economic growth is further supported through the Department's request in the Opportunity, Growth, and Security Initiative. This fully paid for initiative lays out a roadmap for additional investments in critical areas such as research and development, climate resilience, economic development, and manufacturing.

We are committed to working with the Congress to pass a budget that will continue to help create the conditions necessary for businesses to grow and hire, and for the U.S. economy to thrive.

Promoting Trade and Investment

Increasing trade and investment is a critical component of growing our economy. Exports have driven nearly one-third of economic growth since 2009 and support 11.3 million jobs. 96 percent of companies that export are Small and Medium enterprises (SMEs). Today, 95 percent of potential customers are outside our borders and growing the number of export-related jobs, which pay 18 percent more on average, will require expanding our ability to reach these foreign markets. To promote exports and greater investment in the U.S., including foreign direct investment and U.S. companies reinvesting in America, the budget includes \$497 million for the International Trade Administration (ITA), an eight percent increase

over the 2014 enacted level. I want to thank the Committee for their support of SelectUSA in FY 2014 and we plan to put more muscle behind this new program, which will bring more foreign investment dollars to the United States and encourage American companies to reinvest in America.

To reinforce the important role that investment plays in the health of our economy, the budget also proposes to rename the International Trade Administration to the International Trade and Investment Administration. This new name more accurately reflects the Commerce Department's commitment to expanding exports while also making inbound investment and reshoring a bigger part of the DNA of our economy. 5.6 million jobs are supported by inbound investment and the trends are in our favor to attract more. The additional resources requested in the FY15 Budget will enable ITIA, and specifically SelectUSA, to help more states and regions attract additional investments and create more jobs.

Funding requested for ITIA includes \$15 million, a \$7.7 million increase from FY14, to accelerate operations of the Interagency Trade Enforcement Center (ITEC), an interagency effort to address unfair trade practices and barriers to boost U.S. exports, and \$20 million, a \$13 million increase from FY14, to expand SelectUSA.

The Budget includes \$4 million for the Bureau of Economic Analysis (BEA) to improve the measurement and understanding of U.S. foreign direct investment in support of the SelectUSA initiative. The additional funds will support increased export promotion activities in underserved markets around the world. The budget also supports the Administration's BusinessUSA initiative, a one-stop shop to connect business with federal government resources more effectively and efficiently.

The budget includes \$111 million for the Bureau of Industry and Security (BIS), a \$9 million increase, to enforce our export control laws to ensure that our national security is protected even as we foster trade. This will support BIS's continuing work on export control reform, which will help advance national security and economic competitiveness by better focusing U.S. controls on transactions to destinations or end users of concern, while facilitating secure trade for controlled items with U.S. allies and close partners by expanding export control officers operations, enhancing current intelligence efforts, and expanding the bureau's national enforcement and analytical capabilities.

Spurring Innovation

Much of what makes America unique is our spirit of innovation and entrepreneurship. Today, the United States has 6 million workers employed in technology and the highest concentration of knowledge and technology intensive industries in the world, representing 40 percent of our GDP.

To foster a more innovative U.S. economy, the budget will support increased regional and national capacity for innovative manufacturing, continue to support research and development (R&D) that leads to transformative changes in technology, promote intellectual property policy that supports innovation, and continue to strengthen the Nation's digital economy.

The budget provides \$141 million, a \$13 million increase over the FY14 enacted level, for the Hollings Manufacturing Extension Partnership (MEP), with an increased focus on expanding technology and supply chain capabilities to support technology adoption by smaller manufacturers to improve their competitiveness.

The budget also provides \$15 million for the Advanced Manufacturing Technology Consortia (AMTech), a public-private partnership that will support industry-led consortia developing technologies to address major manufacturing challenges faced by American businesses. The Administration has also launched four manufacturing institutes to date and is planning to launch at least four additional manufacturing institutes in 2014 utilizing existing federal funding.

The budget provides \$680 million for the National Institute of Standards and Technology (NIST) laboratories, an increase of \$29 million over FY14, to accelerate advances in top research priorities, including advanced manufacturing, forensics, cybersecurity and disaster resilience, and improved scientific facilities. Included in this amount is \$6 million for NIST to accelerate and expand technology transfer across the federal government, which will enhance the competitiveness of U.S. industry by sharing innovations and knowledge from federal labs. NIST contributes to the success of businesses on issues ranging from cybersecurity to advanced manufacturing. This funding will enable NIST to continue to support economic growth in the future.

To continue expanding broadband capacity and promoting policies to ensure a free and open internet, the Budget requests a total of \$51 million for the National Telecommunications and Information Administration (NTIA), an increase of \$5

million over FY14. This increase will support increasing wireless broadband access and critical telecommunications policy coordination.

The budget includes \$210 million for the Economic Development Administration (EDA) to support innovative economic development planning, regional capacity building, and capital projects. This includes \$25 million for the Regional Innovation Strategies Program to promote economic development projects that spur entrepreneurship and innovation at the regional level. This investment will make our nation and communities more competitive.

The budget also includes \$28.3 million for the Minority Business Development Agency (MBDA) that will enable the agency to continue supporting the national growth of minority-owned U.S. businesses, with additional focus on impacting regional economies and expanding into new markets. Minority owned firms make a significant and valuable contribution to our economy and export at a higher rate compared to all U.S. firms. This investment will promote further growth.

Through implementation of the America Invents Act, the U.S. Patent and Trademark Office (USPTO) continues to make it easier for American entrepreneurs and businesses to bring their inventions to the marketplace sooner, converting ideas into new products and new jobs. Last year alone, the USPTO received more than 35,000 design patent applications and recently commemorated its 700,000th design patent. PTO's estimated fee collections in FY15 are \$3.4 billion.

The budget also proposes several legislative reforms designed to improve the transparency and efficiency of the American patent system, complementing a series of administrative actions the Administration announced in June 2013, which will help protect innovators from frivolous litigation and ensure the highest-quality patents in our system.

Fueling a Data-Driven Economy

Data powers the 21st century economy, and Commerce Department data touches every American and helps existing businesses make better decisions while also providing opportunities for more entrepreneurs to launch startups. The budget will support data-related efforts ranging from our preparations for the 2020 Census to unleashing more NOAA data through public-private partnerships. Each day, NOAA collects and produces 20 terabytes of environmental data – from weather

forecasts to climate change to ocean currents. Yet, only a small percentage of this valuable data, roughly two terabytes, is made easily accessible to the public

The budget includes \$754 million, an increase of \$260 million over the 2014 enacted level, for the U.S. Census Bureau to research and test innovative design methods necessary to achieve an efficient and effective 2020 Decennial Census. The budget also requests \$12 million to invest in the development of three Commerce statistical measures that will improve evidence-based decision making across the federal government and the private sector. This includes \$5 million for the Census Bureau to improve the supplemental poverty measure to allow for more fair and accurate indexing and analysis of poverty programs.

The budget also includes \$5 million for the Census Bureau to increase access to critical business datasets and create a new field of research into the conditions and outcomes of business investments in research, development, and innovation by expanding existing data projects. An additional \$2 million within BEA will initiate “Big Data for Small Business,” a new data program that will collect a Small Business GDP measure to support decision-making by business owners and investors as well as small business analyses.

Gathering and Acting on Environmental Intelligence

The President’s budget makes crucial investments in our environment, including efforts to protect our natural resources and to help businesses and communities adapt to a changing planet. Through our network of satellites, ships, and world-wide sensors, the Department generates models, assessments, forecasts, and tools that provide information to help communities and businesses prepare for and prosper in a changing environment. Importantly, the proposed budget will also keep our satellite programs on track by providing \$2 billion to fully fund the National Oceanic and Atmospheric Administration’s (NOAA’s) next generation of weather satellites, which are critical to its ability to provide accurate information to decision-makers throughout the government and private sector, as well as time-sensitive weather forecasts and warnings that help protect lives and property. This includes \$60 million to procure additional weather instruments for the polar program and helps address the robustness of the polar constellation.

The budget requests \$519 million for the National Ocean Service to make critical investments in products, services and capabilities that will improve the resilience of the Nation’s coasts. The budget also requests \$917 million for the National Marine Fisheries Service to conserve, protect, and manage living marine resources,

including important increases for next-generation stock assessments, and electronic monitoring and coral reef protection.

Conclusion

The smart investments proposed in President's FY 15 budget will support a globally competitive economy by promoting trade and investment, spurring innovation, fueling a data-driven economy, and gathering and acting on environmental intelligence. I look forward to working with the Committee to achieve these important goals.

SELECTUSA

Mr. WOLF. Thank you, Madam Secretary .

I think it is good to encourage foreign companies to locate their manufacturing facilities in the U.S. We can create a lot of jobs that way.

But we also need to ensure that Commerce is fulfilling its goal of working with U.S. companies to export their products. Your budget, in fact, is requesting a larger increase to support foreign direct investment and not to place more Foreign Commercial Service Officers at our embassies abroad.

As you know, the bill carried language on SelectUSA which we put in because you all requested it. And as Members know, I won't beat a dead horse, but there are Catholic bishops in jail today in China, Protestant pastors.

In 1985 or 1986, I snuck into Tibet. What they have done to the Tibetan people is brutal. We had a young Tibetan monk with me who took me into the monasteries. They did not know that he could understand the language. And what I heard them say—they have cameras up on all the buildings and to date, maybe 119 or 120 Tibetan monks have set themselves aflame because of the oppression of the Chinese Government.

We just saw a thing this morning, a press release put out by the department that said Hong Kong, Shenzhen, and Guangzhou are at the heart of China's Pearl River delta and the region has emerged as a global economic powerhouse, et cetera, et cetera.

They are using SelectUSA and said that during the road show American delegates, Commerce will participate and customize one-on-one meetings with potential investors, meet with senior Chinese Government officials and participate in exclusive tours of cutting-edge manufacturing facilities in Shenzhen and Guangzhou.

That really runs counter to the language. I mean, I have a feeling that you do not even know about it—I used to work for a cabinet Secretary and these things came out. And so the agreement includes up to \$7 million for SelectUSA activities, but not to encourage this type of investment.

I think we should attract Indonesia and Spain investments. But because of the intensity of fielding, and I think it is a general consensus, but nobody got up and opposed this amendment, but I think to have this—and as you know, we did, you know, reluctantly put the SelectUSA money in because you persuaded me. And I think you were right. I think it made it very legitimate, but not here.

Could you take a look at it and tell me—

Secretary PRITZKER. Sure. I am happy to take a look at it. Let me say, Chairman, you and I have talked a lot about SelectUSA. And working together, SelectUSA is both focused on helping foreign direct investment as well as helping reshoring. And that is something that is very important to job creation here in the United States.

One of the things, you know, in the last ten days, I was down in South Carolina at the announcement of the expansion of a BMW factory in South Carolina. They are committing another billion dollars to manufacturing, taking their manufacturing of cars from

300,000 cars to 450,000 and increasing the number of jobs there from 8,000 to 8,800 jobs.

And this is the kind of activity that we want to encourage where companies are investing and creating good jobs here in the United States. And they are not only making those cars for the United States consumption but they are also exporting those cars around the world to over a hundred countries.

And so this is the kind of thing that I want to see us trying to encourage occur with SelectUSA. More businesses are recognizing around the world that the United States is a great place to locate for so many reasons that you and I have discussed, like our intellectual property protection, our rule of law, our great investment in research and development.

I think there is an enormous economic opportunity by creating SelectUSA and having it focused both on trying to attract companies like BMW but also trying to work with our existing American businesses to reshore their manufacturing and production capabilities.

Mr. WOLF. Well, if you would look at this and give me a call.

Secretary PRITZKER. I will.

Mr. WOLF. They are meeting with Chinese Government officials, maybe the very officials who were connected with putting Xiaobo, the 2010 Nobel Prize winner, Xiaobo, the Nobel Prize winner is in jail today. His wife cannot even visit him. She is under house arrest.

And so for your people, Select to be meeting, but if you could look at it, we do not want to—

Secretary PRITZKER. I will take a look at it.

Mr. WOLF. Okay. Just give me a call.

Secretary PRITZKER. Thank you.

RESHORING AND REPATRIATION

Mr. WOLF. You and I have discussed the importance of reshoring and repatriation, but I see no mention of it in your budget request. We have included bill language with \$5 million for the past several years for a grant program aimed at assisting U.S. companies to bring back their manufacturing and services. It is not clear whether EDA is actually carrying out this program. And the budget proposes to terminate that program.

From reading the budget, it does not appear that Commerce will be working with U.S. manufacturers to try to get them to come back to the U.S.

Can you please comment on that because starting in fiscal year 2012 and each year since, the Committee has directed the Department to establish a repatriation task force to coordinate those activities across the department? Is the task force in place?

Secretary PRITZKER. Well, the EDA is encouraging reshoring. And one of the ways that we are encouraging reshoring is through our Investing in Manufacturing Communities Partnership (IMCP) program as well as SelectUSA.

The IMCP program was put together to try and get communities to better focus on manufacturing, to put together an integrated plan so that when we make grants, the grants are supporting their

well-honed, well-thought-through efforts as to how to support manufacturing in the United States.

So we are doing a number of different things to support manufacturing.

Mr. WOLF. But the task force.

Secretary PRITZKER. The task force.

Mr. WOLF. The language establishes a repatriation task force to coordinate the activities. I mean, there was a Web page at one time. They took it down.

Secretary PRITZKER. No, no. The ACT task—

Mr. WOLF. It is back up.

Secretary PRITZKER. Oh, yes. No, no. It is on the front page, I think, of our Web site.

Mr. WOLF. Oh, it is back up now?

Secretary PRITZKER. Totally. You and I talked about it. I promised you I would take care of that.

Mr. WOLF. And the task force is in operation and that is back up?

Secretary PRITZKER. The function of the tool is up. Okay. I am not sure exactly what the task force is, so I need to make sure—

Mr. WOLF. Why don't we supply that and then you can—

Secretary PRITZKER. And then let me get back to you. Absolutely.

Mr. WOLF. For the last several years, the Committee has included report language directing Commerce to create an economic security commission and submit a report on key investments being made by our economic competitors in the world economy.

And is there any status on—

Secretary PRITZKER. So the status of that is the report is being created and we are using, since we do not have a separate commission, we are using our manufacturing advisory group to help us review the report. And it is covering a number of different countries. I believe it was China and India. I cannot remember the exact list of countries, but the Economics and Statistics Administration (ESA) is in the process of putting that report together. And it is my understanding it will be completed by year end.

Mr. WOLF. Ms. Lowey or—

Mrs. LOWEY. I am good. Very kind.

Mr. WOLF. I followed instructions. I was told to do that. Mr. Fattah was so supportive, he told me to do that, so I did what Mr. Fattah told me.

Mrs. LOWEY. He is always supportive and we are trying to move this appropriations process, so there are hearings that are overlapping. Thank you very much.

Secretary PRITZKER. Sure.

BUREAU OF INDUSTRY AND SECURITY'S OFFICE OF ANTI-BOYCOTT
COMPLIANCE

Mrs. LOWEY. Madam Secretary, I would like to ask about the Bureau of Industry and Security's (BIS) Office of Anti-Boycott Compliance which enforces the anti-boycott laws under the Export Administration Act. These laws discourage and in many cases prohibit U.S. persons, companies, and their foreign affiliates from furthering or supporting foreign boycotts that are not sanctioned by the United States, particularly the Arab League boycott of Israel.

Can you please talk about the current work of the Office of Anti-Boycott Compliance including any resource constraints or other challenges the office might be facing?

Secretary PRITZKER. Congresswoman, first let me start with the BIS budget request which is asking for \$110 and a half million. We think this is an appropriate amount for us to be able to undertake all of the various activities that we have including execution of export control reform as well as an expansion of some of our foreign offices which we think are very important to be able to allow us to increase the number of end-use checks and things that we are doing.

In terms of our anti-boycott effort, we think that we are appropriately funded and that our request is sufficient for us to do a thorough job.

Mrs. LOWEY. And I would like to work with you on that to see what more we can do to respond.

Secretary PRITZKER. Absolutely. I am happy to get back to you and work with you on that.

Mrs. LOWEY. Thank you.

ECONOMIC DEVELOPMENT ADMINISTRATION—ELIGIBILITY ASSISTANCE

I am proud to represent the 17th district in New York. And even with the economic success of the region, there are communities in economic distress. And I worry that the factors used to determine EDA assistance can dismiss large areas from needed eligibility.

For instance, the eligibility requirement that unemployment rates for a region be at least one percent higher than the national average does not take into account that when a plant closes, the job losses are not restricted to just the county or the town lines. It impacts a whole region but may not substantially drive up the unemployment rate on its own.

Meanwhile, the plant sits empty. Hundreds, sometimes thousands of jobs are lost, and I really would like to work with you on this. And if you can share with me how could the EDA help communities that may be economically healthy but may have pockets where plants have sat empty, jobs have been lost.

Secretary PRITZKER. Well, first of all, Congresswoman, I would be delighted to work with you on this. And the EDA has a number of different buckets of funds that it makes available. One is the Public Works program. We also work on regional innovation. We have economic adjustment assistance which is a more flexible money that could be tailored to meet, for example, responding to a major economic disruption like you are talking about.

And, you know, I think our budget request is about \$47 and a half million in that bucket which is money that could be used to address the kind of scenario that you just outlined, one of which is a plant closing where a community has been severely impacted.

So we have different pockets of money that we use to make grants in an effort to work with communities.

The other thing that we are very focused on is trying to leverage our federal commitments with either private or local dollars so that we can try and get the maximum value delivered to a community depending upon the program, of course.

SANDY SUPPLEMENTAL FUNDING

Mrs. LOWEY. I will follow-up on that as well.

And then lastly regarding the Sandy supplemental, as you know, just over 14 months ago, the Commerce Department received \$310 million after sequestration in the Hurricane Sandy supplemental for a variety of purposes including improvements in weather forecasting, weather research, fishery disaster assistance, repairs of damaged NOAA equipment and facilities, coastal hydrographic measurements along states affected by the hurricane.

Can you update us on the efforts that the department and NOAA have undertaken and are continuing to undertake with the Sandy supplemental funding?

Secretary PRITZKER. Yes, I can. First of all, thank you for the funding to NOAA through the Sandy supplemental.

We are using the funding, and let me give you four broad categories. One is to increase NOAA's computing capacity to allow for better forecasting. We are also using it to help mitigate some of the satellite gap challenges that are being faced.

We are also conducting coastal surveys for safety and resilience and we are working on next generation of storm surge modeling that can be used again for projecting potential impacts of storms.

Mrs. LOWEY. Thank you very much.

Thank you, Mr. Chairman.

I look forward to working with you.

Secretary PRITZKER. Thank you, Congresswoman.

Mr. WOLF. Thank you, Ms. Lowey.

Secretary PRITZKER. I look forward to working with you.

Mr. WOLF. Dr. Harris.

Mr. HARRIS. Thank you very much.

I am just going to ask about several different issues. And I do, by the way, I want to associate myself with the ranking member's comments on the anti-boycott efforts. Those are very, very dangerous things internationally and we should fight against those boycotts.

Madam Secretary, the polar gap in terms of the satellite data for weather, is that being resolved in the budgets?

NOAA WEATHER AND FISHERIES

Secretary PRITZKER. Yes.

Mr. HARRIS. So we are making efforts there. Good.

And do you view the Department, because, you know, we have this little folder here on, you know, America open for business, and under the environment, which I think most Americans, you know, look to the department for weather and fisheries, I mean, those are kind of two big categories, interestingly weather is not number one.

It is kind of number two and kind of climate is really number one which is, you know, the understanding and prediction of change in the environment, the world class science and observation, specifically different from 3.2 which is really weather.

Is that a change in focus? I mean, is the Department really going to focus on its most important part of the environment not being weather but climate because I know this has been brewing in the Department for a couple of years?

Secretary PRITZKER. I would not read into how the list has organized the level of priority. Weather service and delivering the absolute best available information that we can ascertain is a top priority at NOAA and absolutely the number one priority for the National Weather Service.

Mr. HARRIS. Okay. No. Good. I am glad to hear that. Good.

I will just spend the rest of the few minutes I have remaining talking about, you know, what was the latest hot potato, I guess, which is this whole ICANN controversy.

First of all, I guess I have to ask you very briefly, I take it there is a role of the Department in transitioning this to potentially foreign control? I mean, this is your bailiwick, right? It is Commerce Department that is going to make this transition?

ICANN CONTROVERSY

Secretary PRITZKER. Yes. And this—

Mr. HARRIS. Okay.

Secretary PRITZKER [continuing]. Falls under NTIA.

Mr. HARRIS. Okay. So that the quote by—because I understand there was a meeting, I guess, last, let me see, last week in Singapore, so I guess that is probably two weeks ago, two and a half weeks ago, and a Syracuse University professor who attended the meeting said, quote, “Congress really has nothing to say about it.”

Now, that is not really true. I mean, we could not possibly have nothing to say about a function that is being done by the Commerce Department.

Secretary PRITZKER. Well—

Mr. HARRIS. Is this professor fundamentally incorrect?

Secretary PRITZKER. Well, can I explain the situation and let me—

Mr. HARRIS. No. I don't think we have that much time. Is he fundamentally incorrect about that?

Secretary PRITZKER. Well, what Congress has to say is obviously about the actions of the Department of Commerce. I think what he is referring to is legally this is a contract that exists between ICANN and the recipients of a service.

And what we provide at NTIA is an oversight of a contract. And so I think what he is referring to is it is not like we own the Internet and, therefore, it is property of the Federal Government and Congress has that kind of role.

Congress obviously has an oversight role over NTIA and over the Department of Commerce. So I am not exactly sure what the comment is about.

Mr. HARRIS. Well, okay. If it was a decision, a specific decision in the department, I guess, or somewhere in the Administration to—

Secretary PRITZKER. Yes, in the—

Mr. HARRIS [continuing]. To not do this anymore after next year, is that right, not oversee the contract, just—

Secretary PRITZKER. No. What—

Mr. HARRIS [continuing]. Step back from it?

Secretary PRITZKER. No. The situation is as follows: First of all, NTIA which oversees this contract is absolutely committed to a free and open Internet. And it has been anticipated since the inception

of this contract that NTIA would eventually step away from its role. Its role was envisioned as temporary.

And in order to make this transition, and it is a transition process, we felt it was timely, NTIA felt it was timely to begin that transition process because we have one year left in the contract, but we also have the ability to extend the contract for two two-year periods.

So we have a very extensive amount of time for this transition.

Mr. HARRIS. Unilaterally we can achieve to extend the con—
Secretary PRITZKER. We get to unilaterally make this decision.

Mr. HARRIS. Okay.

Secretary PRITZKER. And, therefore, we have said to ICANN in order for us to make this transition, we want to make sure that there is an absolute multi-stakeholder model that we maintain the security, the stability, and resiliency of the internet's domain name system, that it meets the needs of its global customers, and that we maintain the openness of the Internet.

Another criteria that we have set is that we will not accept a proposal that replaces ICANN with a government or intergovernmental organization. So we have a series of criteria that we have set and a process to begin to remove ourselves from what has really been an administrative function of overseeing a contract that exists between ICANN and a set of service providers.

Mr. HARRIS. Okay. So we, but this transition will be to another group, or another entity that oversees it, over a similar limited contract. Just like you say our contract was time limited, their contract will be time limited, the oversight?

Secretary PRITZKER. No, the transition I believe will be that ICANN will remain, ICANN provides a set of services to three different groups, right? We are an administrative oversight of that contract. That administrative oversight function is to recede and not to go to someone else. We believe ICANN has matured enough to be able to execute the contracts on its own. Which it has been doing, we have just been overseeing several functions.

Mr. HARRIS. Right. So we are making sure that those, but once we let this slip out of our hands, once this is out of the box, there is no putting the genie back in his bottle. I mean, we have had the function for 16 years. You say it is temporary, but 16 years we have been doing this.

Secretary PRITZKER. Right.

Mr. HARRIS. Once we let this genie out of the bottle, you really cannot get it back in. I mean, we really will have taken a step that may not be, and as a matter of fact the only reason I say this is because in the context I am far more concerned this year than I was last year. Because we actually have, you know, this country called Russia that is basically trying to expand its domain using Internet control or suggesting control over opposition groups. Let me put it this way, the world is less free today than it was two months ago. I suspect it may be less free a year from now than it is today.

One of the things we do is we are actually pretty certain that the Internet does not become a tool of governments that choose to oppose freedom of the Internet. There is no question whether it is, it is even some of our allies, I mean, Turkey, you know, saying that

we are going to somehow, you know, not allow Facebook, or we are going to put a tax, an effective tax on, I mean, these are all things that have been discussed. This is not like these are secrets. These are things that have been discussed that are very antithetical to our ideas of the First Amendment. And if we believe that we are a force for expanding liberty and freedoms espoused by the First Amendment, why would we let this, why would we even talk about letting this genie out of the bottle? I do not get it.

So those are rhetorical questions. The real question I have is it does take funding for your department to do this transition. So the professor is wrong. We clearly have a say because we have a say in the funding of the department.

Secretary PRITZKER. Exactly. As I said, you have an oversight function on that. So I am not exactly sure what his—but let me, Dr. Harris, may I assure you to something. We at the Department are committed to a free and open Internet and your concerns about another government or that freedom being reduced are shared by us. And what in the process of this transition, unless we are satisfied that these functions, these services can be provided in a way that we feel that they are not at risk, the criteria that I talked about: losing multi-stakeholder, or not satisfying our customers, or if there is any risk that we think that I could be replaced by a government of some other sort, then we will not proceed. These are criteria that we have set up. Because protecting a free and open internet as you described is something that we value absolutely. It is extremely important, as you said, not just to the First Amendment, to commerce, to government, etcetera.

Mr. HARRIS. Well I am just going to close by saying this is just not my concern. Let me quote Bill Clinton on this. Because the former President, who I think has a pretty good read of what is happening internationally says I quote, and this was in a panel discussion recently at a Clinton Global Initiative event. “A lot of people who have been trying to take this authority away from the U.S. want to do it for the sole purpose of cracking down on internet freedom, and limiting it, and having governments protect their backsides instead of empower their people.” Mr. Chairman, I yield back.

Mr. WOLF. Well thank you, Dr. Harris. And I am going to go to Mr. Fattah. But I share Dr. Harris’ feelings and I think this Committee ought to act. We saw the U.N. with regard to Syria. The Administration tried to get resolution after resolution, 140,000 people have been killed. We cannot not move it. We have seen with regard to Crimea with regard to Russia. We have seen anti-Israel things coming out of the U.N. that we cannot get China to go with, Dr. Harris is exactly right. And also former FCC Chairman Julius Genachowski said multilateral organizations have already taken disturbing steps. At the 2013 International Telecommunication Union Treaty Conference in Dubai, a majority of countries joined Russia, Iran, Iran, and China in supporting a measure calling on the ITU, a United Nations agency, to play a large role in international internet governance.

Senator Warner who I just left, and I was with Senator Warner and Governor McAuliffe, said, “The U.S. has been inherently involved in the oversight of the internet since its creation and this legacy of authority and stewardship over ICANN has ensured the

internet has remained stable, secure, resilient, and open. This transition raises serious concerns.” And then Senator Menendez said, “I have not had a chance to engage but I generally would have a predisposition against it.” So I think the Committee, if the authorizers would like, and we will wait, because we want to, you know, I think the Committee ought to block it. I think we ought to do everything. And if we give it up you will be gone, I will be gone, everybody will be gone, and all of a sudden we will say look what is happening.

When you go to China now and go to an Internet cafe, type in the Dalai Lama, he does not exist. Type in Xiaobo, he does not exist. If what we have seen coming out of the U.N. in Syria, on Crimea, on these anti-Israeli resolutions. Have you seen some of the resolutions coming out? We will say, oh, if only. So we ought not go down this path. I agree with Dr. Harris. Mr. Fattah?

Mr. FATTAH. Thank you. And Madam Secretary, you have transformed Capitol Hill. Because now the majority is for more government. And so we have arrived I think at a moment of consensus. Because this is an argument for the U.S. government and its importance in a role in one of the most critically important infrastructures in our lives, the internet. So I want to thank you for that.

And I want to go back to my opening statement. So the International Monetary Fund yesterday said that the stronger U.S. growth this year and next will help the world economy withstand weaker recoveries in emerging markets, including Brazil, Russia, and it goes on to talk about Japan and Europe and how important the work of your department has been in this administration. So we have almost 50 months, 49 months of consecutive job growth, almost 9 million new jobs. But what is important is inside these numbers, this uptick in manufacturing. Also when the President announced that he wanted to substantially in a disruptive way improve our exports, you know, build it here, sell it everywhere, that a lot of the comments, and I remember reading in the New York Times people saying oh, you know, this is not practical. This is, you know, manufacturing, we cannot do this, and so on. And you have proven them wrong. This administration has proven them wrong through the great work of the department.

And you talked about exports. I brought the Import-Export Bank and some of the other people into Philadelphia to talk about export opportunities for our businesspeople. And it is fascinating, only one percent of American companies export to any other country. And 57 percent of that one percent, Mr. Chairman, export only to one other country. That is that we really do need to raise our vision about where the markets may be for the sale of goods and services beyond just the borders of the United States. So the administration has done a lot of work in this area and you are well ahead of pace, of what was the goals in this effort. But we need to do more.

And the other thing about SelectUSA is that you created something that is so important for businesspeople because now they can go, it is a one-stop shop. Because when we think about the Commerce Department and all of the instruments that are at your disposal to help assist businesses, you know, you have got all these alphabet soup named agencies. But for an entrepreneur, they just want to go somewhere, talk about what they are trying to do, and

have someone at the governmental level figure out whether there is some assistance to be provided.

So this is very important. And there was a lot of resistance to these efforts that have now been overcome. I think that we now see and there is a sense that this American recovery, which is very distinct from these other economies, you know, has been handled in a very good way in terms of making sure that the efforts that were needed in terms of the governmental levers to allow the private sector to be able to regain its footing to go forward. So I want you to just talk a little bit about how you see the U.S. economy's role now given your perch going forward. And not only what the International Monetary Fund, what the World Economic Forum talks about in terms of innovation being at the forefront. So talk to us just a little bit about your vision as the new Secretary of Commerce.

INVESTING IN THE U.S. ECONOMY

Secretary PRITZKER. Well I think that first of all obviously the International Monetary Fund is spouting a point of view that completely concur with and they have supported it with a lot of data. But if you start with the very fundamental things that I think are really important to remember, if you look at the rule of law that exists in our country, our intellectual property protections, you look at the commitment that we have made to research and development, our great universities, the low cost and abundant energy that we have in our country, and not the least of which is the ingenuity and the flexibility of the American worker. And these are great assets that make the United States, and you add to that a financial system that has recovered and is providing access to capital. The United States stands tall as a place where companies from around the world want to invest.

The other interesting thing that you see is they want to be here because they can make products here and successfully. But also because we have good laws and good processes and we need to continue to invest in our infrastructure and the ability to export. And one thing we know is that 11.3 million Americans have their jobs because of exporting. And those are well paying jobs. And 5.6 million Americans work for American subsidiaries of foreign companies. And those jobs pay about \$77,600 a year.

So my vision, you know, and the Department's vision is to continue to invest and to try and create the conditions in which the American economy can grow and we can create jobs in this country. The private sector creates the jobs. Our job is to create the conditions. Doing that helps improve our ability to export, helps encourage companies to invest in the United States and grow their manufacturing here in the United States. It is to work with manufacturing companies. And one of the things that I am very excited to see happen is the potential for the National Network of Manufacturing Innovation, which I think has bipartisan, bicameral support and I think is a great investment on the part of the federal government and a wise use of taxpayer dollars. That legislation proposes that we would spend, let us say, \$50 million to \$70 million per institute to create a series of institutes across the country what we have seen from the pilots that have been done.

Every one of the four pilots that have been created to date have had many, many, many communities come together wanting to have those grants. And I have talked to a number of the organizations that have come together, universities, community colleges, the private sector, and the local governments that come together to create one of those institutes. And what do they do? They do pre-competitive research and they help take that innovative technology to market and get passed the most risky parts of getting a technology to where it can actually be taken by companies and brought to market. I think that is a great opportunity.

So one of the things you will see in our budget is lots of investments to try and encourage exports, try and encourage reshoring in foreign direct investment and encourage the growth of manufacturing. As well as making sure that our Weather Service, which is absolutely essential to the growth of our economy that we do a good job there.

CORPORATE TAX REFORM

Mr. FATTAH. I have visited the Weather Service. I know it is very important. Let me ask you a question. The administration has pushed for corporate tax reform. As the Commerce Secretary, do you see that even though we get credit for helping to lead in the world in terms of recovery, that this is an important area that the administration still has interest in working? I know that we had the Dallas Fed Chair making some comments about the fact that we could do more to help move our economy forward. And I would be interested in what your perspective is on this?

Secretary PRITZKER. The administration supports corporate tax reform. And what the corporations will tell you is that our corporate tax system as currently configured is not globally competitive. And it is encouraging them to keep their dollars offshore and not invest in the United States but instead to borrow here and invest elsewhere. And so addressing those issues could have an enormous—

Mr. FATTAH. The latest report is that there is \$2.1 trillion offshore.

Secretary PRITZKER. Yes.

Mr. FATTAH. Because of this imbalance. And I am interested because of my interest in manufacturing, you said that our tax system is not globally competitive. I am interested in how our business tax system affects manufacturers in a—well, I do not want to put words in your mouth. How you think reform of it may aid manufacturing?

Secretary PRITZKER. Well I think that, you know, in bringing corporate tax reform, the President has proposed bringing corporate tax rates down and for manufacturers down to the rate of 25 percent. That would make them more globally competitive and it would make the United States an even more globally competitive place to locate one's manufacturing. And so I absolutely support that and think that the administration is in the right place to do that.

Mr. FATTAH. Well let me thank you, and I am going to yield back to the chairman. But I am very supportive of the whole range of activities of the department.

Secretary PRITZKER. Thank you.

Mr. FATTAH. I think EDA has some fabulous work, and also the export efforts. And we have to get you to Philadelphia so you can talk to some of our local business leaders.

Secretary PRITZKER. Thank you.

Mr. FATTAH. But I will yield back at this time. Thank you, Mr. Chairman.

Secretary PRITZKER. Can I just say one thing, Congressman? I appreciate your talking about the employees of the Commerce Department. I believe the greatest asset are the people who work for us. And they are really dedicated to trying to create the conditions for economic growth in the country. So thank you.

Mr. FATTAH. Thank you.

Mr. WOLF. Mr. Aderholt.

Mr. ADERHOLT. Thank you, Mr. Chairman. And Madam Secretary, thanks for being here today.

EDA FUNDING

Secretary PRITZKER. Thank you.

Mr. ADERHOLT. You may recall about three years ago there was a series of outbreak of tornados that hit the South. Alabama got hit in a very big way. The district I represent in the northern part of the state got hit in a very big way. And one of the particular small towns in my area, Hackleburg, applied for an EDA grant in the aftermath of the tornados that went through, which as like I say has been almost three years ago. It destroyed entire neighborhoods, buildings, vital infrastructure there in the community that I represent.

The grant was awarded but it took more than a year to actually receive the funding. I have heard from local community leaders that these kinds of wait times are not unusual and do not seem to be better even if you have a natural disaster. My question to you would be is there any EDA directive to streamline the funding process after a grant is awarded in the wake of these type of tragedies.

Secretary PRITZKER. Well first of all, Congressman, my heart goes out to the families and citizens of the community hit by the tornado. That is terrible. The EDA is, I will say a couple of things. First of all in defense of EDA, we are not like FEMA in the sense that we are sort of able to grant in kind of an emergency situation. We have a process that we go through. I am excited to say that we have a new head of EDA has been named and nominated and I am hopeful is going to be confirmed by the Senate still in this working period and he is a former mayor, Jay Williams. And his commitment in talking with me about taking this job is in how do we be most responsive to communities. And to come in and look at the EDA processes that we have and are focused so that we can become as responsive as possible, recognizing that our role is a little different than FEMA's role in terms of—

Mr. ADERHOLT. Right. No, I understand your role. But I mean, over a year is vastly different from being on the ground within 24 hours. So yes, we understand that you cannot be on the ground 24 hours later but you know I think over a year is really—

Secretary PRITZKER. I will tell you, as part of my directive with him, is to really take a look frankly at all of EDA to see how we can streamline our processes.

Mr. ADERHOLT. Do you know how long it takes typically to get money when something like this occurs?

Secretary PRITZKER. I do not have those figures at my fingertips but I am happy to look into it.

Mr. ADERHOLT. And just, you know, the other thing that I think would be interesting to look at is see what the wait time for standard EDA grants, how would it compare when you have a disaster like that as opposed to and also I would be interested to know if you could check to see if timelines vary according to the region you are in. But you know, this, like I said, this, you know, over a year I think has gone beyond. And I would appreciate when you, as you move forward with this new person at EDA that you would call this to their attention and say this is something that we need to look at and it is a real problem out there.

Secretary PRITZKER. Absolutely. And I will look into the times it takes—

Mr. ADERHOLT. Okay.

DUMPING AND SUBSIDIZED STEEL

Secretary PRITZKER [continuing]. That you have raised.

Mr. ADERHOLT. Okay. Let me just quickly in closing, I have got one more quick question, of course the United States is currently facing a steel import crisis with dumped and subsidized steel imports from a number of countries and across various product lines that are flooding the markets. The imports are causing injury to our steel industry and its workers. It is impeding domestic industry's full recovery from the economic recession.

In response the domestic industry has brought several new trade cases in recent months against unfairly traded imports, including cases on rebar and oil country tubular goods, known as OCTG. Both of these industries desperately need relief but I understand there is some concern that a number of the Department's preliminary decisions in these cases may have been inconsistent with its standard practice and methodologies and the Department MAY have exercised its discretion in a manner that is detrimental to the domestic rebar and OCTG industries.

I also understand that the United States industry provided clear evidence of numerous subsidies yet in many of these instances the Department declined to make a preliminary ruling putting off the decision until the final does nothing to deter the imports that are flooding the market currently even as we speak. While I understand the Department has significant discretion in many areas under the statute, do you agree that it should not exercise discretion in a manner that harms the American worker and the industry?

Secretary PRITZKER. Congressman, you know, to date I believe we have around 31 antidumping and countervailing duty orders on steel related products just from China alone and I am familiar with some of the cases that you brought. And as you said, there is some discretion but not a lot of discretion. We proceed with these cases very very seriously. We encourage the parties that engage to make

sure that all the facts are put on the table so that the review can be thorough and can be transparent. We are very transparent about the facts we find in the preliminary rulings and what we think the damage might be. And then we encourage another view between the preliminary and the final ruling to make sure that we have gotten the appropriate information so that we do not have an erroneous finding, if you will.

Mr. ADERHOLT. Is there anything that, as far as due to lack of resources, that this Committee can address?

Secretary PRITZKER. You know, as far as I am aware there are sufficient resources to deal with the level of antidumping and countervailing duty cases that we have to date. Thank you.

Mr. ADERHOLT. Well I think it is critical for the Department to go after—

Secretary PRITZKER. Absolutely.

Mr. ADERHOLT [continuing]. Unfair trade practices whenever they occur and wherever they occur and put the necessary resources to investigate and discipline any wrongdoing. So I would just like your assurance from the Department of Commerce that you will certainly apply these U.S. remedy laws and you know, and make sure that you have the adequate resources to do that.

Secretary PRITZKER. You absolutely have my assurance and we take these cases extremely seriously.

Mr. ADERHOLT. Okay. Thank you, Mr. Chairman.

Mr. WOLF. Mr. Schiff.

Mr. SCHIFF. Thank you, Mr. Chairman. Welcome, Secretary, it is great to have you here.

Secretary PRITZKER. Thank you.

Mr. SCHIFF. Thank you for the good work you are doing. I want to raise a couple of issues about the PTO. I appreciate the efforts that have been undertaken at the Patent and Trademark Office to examine the notice and take down system under the Digital Millennium Copyright Act, and the degree to which it is accomplishing its purpose of combating online infringement. PTO most recently convened a meeting of stakeholders on their effort in March with input from a variety of people about their experience. I am concerned that the current system is broken and I would like to figure out ways we can make it work better, ideally through cooperative and voluntary engagement through venues such as the PTO.

I have the privilege of representing many constituents who create content for a living, whether films or music. And I hear all the time about the frustration of sending endless numbers of take down notices only to see the same files uploaded literally instantaneously. That is not the way Congress envisioned the process working in 1996 when the DMCA was passed.

It is a particularly overwhelming issue for small and independent creators who cannot afford to hire teams of people who do nothing but send thousands of take down notices day after day. One promising idea that came out of the initial discussion at PTO would be to at least standardize the format of take down notices so they can be processed more quickly. I would also like to see search engines take notices into account to downgrade the search results of frequent abusers, something they have committed to do but we are not really seeing the results yet. So I would welcome your thoughts

based on what you have learned so far about how we can make a difference in protecting the work product of millions of Americans in the creative industries.

PTO ART RIGHTS

Secretary PRITZKER. Well Congressman, first of all we completely support the rights of those who are in the creative industry and one of the things that I did very early on was spend time in Nashville with the Songwriters' Association talking with them about the challenges that they face in terms of protecting the rights of the product that they create. And for us making sure that notice and take down is implemented appropriately is something we take seriously. I will look into the issue of standardized format. I do not know what we do in that case right now but I will make sure and look into it and get back to you about that. And protecting those from, it is a real problem, frankly. But it is something that I will look into.

Mr. SCHIFF. Thank you, Madam Secretary . I look forward to following up with you on that. Staying on the PTO, last year the Inspector General for the Department of Commerce expressed concerns about the development of a secondary backlog at PTO. The IG acknowledged that progress has been made in reducing the backlog in patent applications and reducing overall pendency, including clearing out some of the oldest unexamined applications. But he voiced concerns about a growing number of applications that are now under appeal through the administrative process within PTO. Two points on that. First, to the extent there is a new backlog developing in the appeals process it is important that PTO stay on top of it and increase resources and staffing to deal with it. Second and perhaps more important, we need to ensure that the secondary backlog is not the result of a decline in the quality of PTO reviews which have caused more appeals. I would appreciate it if you could look into that issue as well and get back to us about the IG's warning from last year. I would like to know whether the secondary backlog is in fact growing, and whether we are seeing a higher rate of appeal than we have in the past and whether there is any evidence that in our zeal to reduce the backlog we are granting patents we should not or rejecting patents that we should be granting.

PTO BACKLOG

Secretary PRITZKER. So Congressman, let me just give you a little bit of some information now about that and I am happy to give you more later. We are continuing to grow the Patent Trial and Appeal Board. It is difficult, though, to find qualified candidates, but we are trying to deal with that. In terms of the backlog, we have brought the backlog down to about 600,000 cases. Our target is to bring it down to 450,000 cases. And we think that is the right amount of backlog because, and we are growing, at the same time we are growing our patent examiners by another thousand examiners this year to I think 9,000 examiners. And when you hire a new patent examiner there is an enormous amount of training that goes into making them effective, right? And that training could take up to a year. So what we are trying to do is end up with the

appropriate amount of backlog to keep our patent examiners efficient and effective at responding to new patent applications, as well as to make sure that we have a level inventory of work that we are doing. And so this is a constant balancing act, if you will.

This is a constant balancing act, if you will, but we are applying IT resources as well. In fact, in this budget, we call for increasing the amount of IT infrastructures spent for an additional \$8 million so that we can streamline, both, the interaction with the applicants, but also improve the quality of examination of prior art, which is something that you were referring to—without deluding the quality of patents in an effort to deal with the backlog.

One of the ways that we are addressing that is both the patent training—patent training of our examiners and we are going through an upgrade of training this year. We have a big effort going on this year. So the amount of backlog won't go down as much this year because we are improving the quality of training. We are also improving the quality of our IT system which will help us do better search of the prior art, which will then improve the quality of the patents. At the same time, we are trying to grow our Patent Appeal Board so that we can timely deal with those.

Mr. SCHIFF. Well, thank you.

I think the numbers that you are referring to are the—for the patent backlog are not the secondary backlog in the appeals process.

Secretary PRITZKER. Oh, no, I am giving you the primary backlog—

Mr. SCHIFF. Right.

Secretary PRITZKER [continuing]. And the secondary backlog, I will look into the specific numbers. I don't have those at my fingertips.

Mr. SCHIFF. Okay. I am very interested to know whether that backlog is growing, as the IG was concerned, and if there is any indication that it is growing because we are moving too quickly to reduce the primary backlog.

Finally, it has been more than a year since PTO Director David Kappos stepped aside. I have no doubt that the acting director for PTO is very capable, yet, I think it is a particularly bad time for the Department to lack permanent leadership with Congress considering a variety of proposals on patent reform to combat the problem patent trolls and frivolous demand letters. These are tricky and technical issues and it is important that we get them right and we will need input from PTO to make sure that we are striking the right balance.

I realize it is beyond your pay grade to put forward a nominee, but I would encourage you to pass long to the White House the importance of nominating a new PTO director soon.

Secretary PRITZKER. Congressman, there is no one who wants a Patent and Trademark Office under Secretary more than I do. Having said that, I have will tell you that the acting Michelle Lee, who was formerly from Google, is fantastic and is doing a terrific job. But we are on top of it and I am working closely with the White House to get this addressed.

Mr. SCHIFF. Thank you, Madam Secretary . It is great to see you.

Secretary PRITZKER. Thank you.

Mr. SCHIFF. I yield back, Mr. Chairman.

Mr. WOLF. Mr. Diaz-Balart?

Mr. DIAZ-BALART. Thank you very much, Mr. Chairman.

Thanks again for being here today.

Secretary PRITZKER. Thank you.

Mr. DIAZ-BALART. A couple of issues that I wanted—and one of them may sound to some—as something that is way far in advance—but it is the issue of the census.

Secretary PRITZKER. Yes.

Mr. DIAZ-BALART. And obviously it is one of those issues that if you don't get it right now and soon and when we get there, we are in deep trouble, right?

And so I know that your budget request includes \$1.2 billion. That is for the ramp-up of the census which is an increase of about 28 percent, and again, we all understand the necessity of the census and also understand what you are doing, you are looking at technology to hopefully lower costs, et cetera, but any idea what—the 2010, was—\$13 billion, I believe was the total number. What do you expect the 2020 census to cost, is it going to be more, do you think, and equally as important, if not potentially more important and money is important, but based on the recent GAO report, are you confident that the census will have the technology and will be ready before 2020?

CENSUS 2020

Secretary PRITZKER. Congressman, thank you for asking about the census. You know, first of all, let me assure you that our goal is to make sure that we provide a timely, trusted, and accurate census, and we are also focused on how we do that at a lower cost per household.

And we are researching the innovations that we think can help us to save, frankly, billions of dollars. One of the biggest costs that we have in the census is non-response. If we do the census the way we did the 2010 census, our estimates are that it will cost us \$18 billion to do the census. We think that we could save up to \$5 billion by making it easier to respond; by leveraging the Internet; by using modern approaches to our field operation by using data that has already been provided to the Government and by having more targeted address list development.

And our objective is, during fiscal year 2015 with the increased resources that we have asked for in the budget, is to test all of these efforts to see that they can deliver the kind of savings that we are projecting that they can, and I have a lot of confidence in our census—our Assistant Secretary running the census, John Thompson, that he is on top of our conducting this research in a timely fashion so that we can be ready to effectuate the census at the appropriate time.

Mr. DIAZ-BALART. And I think that that makes sense, I mean, looking at, again, new technology and other ways to not only make it less expensive, but, more efficient and more accurate.

You know, after the last census, the City of Miami and Hialeah, they saw dramatic decreases in many of their Formula Grant programs, specifically in CDBG funds. We had multiple meetings with the census folks. They were great; they were responsive. And in es-

sence, the folks in Hialeah and Miami, just couldn't believe that the numbers were accurate because, they are not rich cities. As you know, they are poor cities and the numbers didn't make sense and—it appeared that, for example, Miami that census was counting unoccupied high-rise condos after the collapse of the market, and so there was all these issues.

And one of the things that we also hope that you are looking at—and, again, I appreciate that you are looking in innovation.

Secretary PRITZKER. Yes.

Mr. DIAZ-BALART. But it is to also figure out ways to be more in contact with the local communities, who, in many cases—and in some places in south Florida, as you know, where we are basically the exile community of particularly all Latin America.

Secretary PRITZKER. Uh-huh.

Mr. DIAZ-BALART. There is a strong reluctance to trust in Government, and so hopefully that is something that you will also look at to try and do a good job there.

Secretary PRITZKER. We are committed to making sure that we have an absolutely accurate census and working with local governments.

Mr. DIAZ-BALART. Mr. Chairman, do I have any time to ask one other question?

Mr. WOLF. Absolutely.

NATIONAL TRAVEL AND TOURISM

Mr. DIAZ-BALART. And this is kind of unrelated to you but—it is related, but it is not really in your realm—but the President launched the National Travel and Tourism Strategy—

Secretary PRITZKER. Uh-huh.

Mr. DIAZ-BALART [continuing]. To make the United States more attractive and accessible as a destination, which obviously in south Florida, we are all in favor of that attitude. Many of the visitors that come to the United States, come through Miami, through south Florida. It is one of the largest—Miami is the second largest international gateway to the United States. We have a serious issue, however—and then we also have the folks that are going to go to the World Cup, who, a lot of them, we think—we hope will pass through south Florida on their way there and spend a lot of their money, et cetera—and one of the concerns is the fact that we just don't have enough CBP officers and the wait lines are frankly, clearly unacceptable.

This committee, the Appropriations Committee, did a great job and so there are going to be some new ones going to south Florida, so I clearly realize that CBP staffing issues are not handled by you—they are handled by DHS—but given that the Department of Commerce's role in attracting visitors, is that an issue that you all have talked about, to look at reducing those waits, that obviously—even though you don't control that, but it does affect what you are trying to do—and I am hoping that that is something that can be addressed at the interagency level.

Secretary PRITZKER. So, Congressman, first of all, the National Travel and Tourism Strategy came out of the Department of Commerce as something that I chair the interagency effort on the National Travel and Tourism Strategy, and I am quite excited, frank-

ly, with the partnership that we have developed with the Secretary of Homeland Security. In fact, he commented to me, he thought he was in charge of a law enforcement agency, but he realizes that there is an enormous trade component that he has engaged with, and he and I have spent significant time—and yesterday announced to both of our staffs a set of principles, in terms of commitment, to travel and tourism and trade to work very closely together.

And we have an initiative, interagency initiative, that we're working on to bring down the wait times. Because we only have one chance to make a first impression on the travelers that we do want in this country. We have seventy million travelers who came to the United States last year and our objective is to get to a hundred million by 2021, and if we can't bring down the wait times, then these folks are not going to return again or be encouraging the others that they know to visit.

So it is a high priority for those of us at the Department of Commerce and I feel very good that Secretary Johnson is, number one, committed to our Homeland Security, but acknowledges that there is still an opportunity to accomplish that, at the same time, as addressing the wait lines.

Mr. DIAZ-BALART. Mr. Chairman, thank you, again, for your indulgence.

I am glad to hear that you are also focused on that because, yes, it is an issue that, as you say, we only have one shot at it, and right now we are not doing really well in some highly utilized areas like in Miami where we did the wait line.

We had, Mr. Chairman, a couple of weeks ago, the wait line was over three hours. So people were missing flights and you can imagine that when the numbers increase, which we need them to increase, and for example, just during the World Cup that is taking place in Brazil, if we don't deal with that, we are in serious trouble, but I am glad to hear that you are doing that. And I, for one, anything that we can do to help, please stay in touch.

Secretary PRITZKER. And I would just add something—Congressman, in fact the—one of the things that the Secretary of Homeland Security asked me to do is to help him get loaned executives from some of our private sector companies that are experts in dealing with these areas of wait lines.

Also, I know that they are speaking on behalf of—not of the Commerce Department, but a department—they are deploying kiosks and they have—the beta site was in Chicago and actually early on in my tenure, I did go through that site. We were traveling outside the United States and we connected through Chicago and we re-entered the country through Chicago and were able to use the kiosks and talk with the head of CBP there. And what I would say is that they are very focused on the challenge, and I think the Secretary is very committed and we are working very closely on it.

Mr. DIAZ-BALART. Thank you, Madam Secretary .

Secretary PRITZKER. Thank you.

Mr. DIAZ-BALART. Thank you, Mr. Chairman.

Mr. WOLF. Mr. Honda?

Mr. HONDA. Thank you, Mr. Chairman.

This is a very interesting discussion. On the wait lines—just so I don't step on anybody else's line—the wait lines have been a real difficult thing to deal with, essentially after 9/11 in the airports. And before it went to DHS, the Secretary went to Disneyland because Disneyland is an expert on wait lines, and so, you know, we may be looking at other areas that we never think about to bring in their expertise to help us out.

Secretary PRITZKER. Well, Congressman, just on that note, the folks at Universal and at Disney have offered to help the Secretary of Homeland Security on just precisely this issue.

Mr. HONDA. So I think that, you know, Mr. Diaz-Balart's comments are timely and in talking about the census, I think that is timely too because even though it might be ten years down the line, it is still, on an annual basis, we have to stay on top of the issues, especially with the issues around technology—

Secretary PRITZKER. Yes.

Mr. HONDA [continuing]. When the last go-around, it was a fiasco and an embarrassment.

But I just wanted to welcome you, Secretary, for coming in.

Secretary PRITZKER. Thank you.

Mr. HONDA. And I also want to thank you for coming to Sunnyvale in our district back in February. It was really a good visit. We did talk about USPTO and we just want to also express the gratitude that USPTO is in San Jose.

But I share the concerns of my colleague, Adam Schiff, regarding the backlogs and everything else like that. I was wondering if that backlog was due to the way that we are not allowing the income that is coming from fees to be utilized in an appropriate manner, the way that it was supposed to be used, for the USPTO.

Can you comment on that?

PTO FEE USAGE

Secretary PRITZKER. Well, one of the things that I am excited about is that the fee level, I think, this year is projected to be about \$3.2—\$3.4 billion, which is a 14 percent increase.

Mr. HONDA. They increased it, right.

Secretary PRITZKER. And so this is going to allow us to do several things. First of all, invest in our IT system, which you and I discussed—

Mr. HONDA. Right.

Secretary PRITZKER [continuing]. At another time and the importance of that. That got delayed due to various reasons and now it is really important that we continue this investment in our IT infrastructure because that will both empower the new examiners that we have to be more effective and also to streamline the work that they do.

I think that we are also building a good operating reserve, and the reason I think that is important is because as we have economic ups and downs, it is important that we not lose the assets of—the great human capital assets of the Patent and Trademark Office. As I said, the examiners are folks that we invest highly in when they join us and they become real experts and able to really become more efficient and effective at granting patents. So what we don't want is the ups and downs of the economy and maybe the ups

and downs of fees to affect our ability to keep a strong workforce so that we can be servicing the innovation economy. So I feel that I am actually—having continued to examine this, I feel really good about where we are at.

Mr. HONDA. Well, I think the way that the money was flowing—not flowing appropriately, it seems to me, that affects states like California and Virginia, the chairman's district, where we depend upon the processing of patents and trademarks as part of our economy. And when that slows down, it slows down everything, so I think it behooves the entire country that we understand how to support the USPTO. And I don't know how we are going to do it, but I think the sequestration should not have impacted your budget because it was fee-based and not based upon monies allocated from our budget.

Secretary PRITZKER. We think with the fees that we are going to have this year that we are going to be able to adequately address the challenges that we faced before, so we feel good about where we are.

Mr. HONDA. Okay. I just want to make sure that you know that folks like us are willing to push, because when you experience a backlog, you end up getting blamed if we don't understand how—what is really happening and I think we need to expose that and make sure that all of us understand the kind of challenges that you face really depends on the flow of your funding and it affects your staffing, your training, your backlogs, and everything else like it. It ultimately ends up determining how well we do in this country in terms of protecting our patents and providing patent protections.

PROMOTING INNOVATION

Secretary PRITZKER. Absolutely.

Mr. HONDA. So now I will get back to my notes. So on your commitment for promoting innovations through initiatives like NNMI and entrepreneurship and boosting the American competitiveness, you know that those priorities, we do have in common on investing and rebuilding our domestic manufacturing base.

In Silicon Valley, one out of five jobs are in the manufacturing sector and we are the number one area for manufacturing, Detroit is number two. I was told by Detroit that we are number one. And I don't have to tell you that not all jobs are created equal. Manufacturing jobs pay higher wages than most jobs in the service sector.

We need a national manufacturing vision, the way that Silicon Valley has vision for manufacturing, so we can have more American jobs that pay better wages and a strong economy. We want to make sure that we invest and enhancing the competitiveness of our small and medium-sized manufacturers.

I am glad to see that the 141 million requests for the National Institute of Standards and Technology, NIST; Manufacturing Extension Partnership, the MEP, I am glad to see that, and in California, MANEX, in northern California, CMTC. In southern California we play a critical role in helping small manufacturers in our state create and retain jobs, increase profits and save time and money. The MEP provides important services from innovation strategies to process improvements, to green manufacturing. It also works with partners at the state and federal levels to help pro-

grams that put manufacturers in positions to develop new customers, expand into new markets and create new products. These investments will help our manufacturers overcome today's and tomorrow's challenges so that high-paying skilled labor can find a good home on our shores. So would you talk about the Commerce Department's goals for the MEP program and where it fits in, in the Administration's manufacturing vision?

Secretary PRITZKER. Well, Congressman, I, too, think the MEP program is really terrific. When I took this job, I was unfamiliar with the MEP program and so I made it my business to go out and visit with a number of manufacturers, particularly some small manufacturers, and talk with them. The MEP program is a program that partners with local groups and works as an advisor to local manufacturers, particularly small manufacturers, to help them adopt state-of-the-art processes and programs to be competitive. And it is fantastic when you see the effect of their work. First of all, the federal dollars are well-matched, locally, which is something that is important.

Mr. HONDA. Yeah.

Secretary PRITZKER. But, also, it is great to talk to a manufacturer and hear about the streamlining, the effectiveness, the efficiency, the processes that are brought to bear through the consulting work that our MEPs do, so I think it is an extremely important part of our manufacturing agenda.

Mr. HONDA. While you were mentioning that, and there was a discussion earlier on asking for consultants to help solve problems, I think someone said that we are looking for experts in the different fields to help solve our problems.

Was that—

Secretary PRITZKER. That was for the Department of Homeland Security.

Mr. HONDA. One of the bills that we wrote is called EIR, the Entrepreneur-in-Residence, and it is a no-cost bill that we were trying to move forward and perhaps the members of this committee and the chairman might want to look at it to help us move it through. It is no-cost and it is looking at entrepreneurs who are successful and they are willing to volunteer their time for two years without pay, they would absorb it, and to be placed into different departments and perhaps into DHS to help places like Florida to solve their problem with the backlogs. If the chair wouldn't mind looking at that and discussing with yourself on that, it may be something that will benefit a lot of departments, a lot of neighborhoods in terms of the kinds of strategies that we may be able to pull from the experiences of the entrepreneurs that are successful.

Secretary PRITZKER. I am not—

Mr. HONDA. They don't need an income and so they are prepared to volunteer, and Oracle and a couple of other companies have already done that, and so we are moving forward on that, so I would love to have that shared with you.

Thank you, Mr. Chairman.

Mr. WOLF. We will take a look at that. It sounds like—years ago there was the SCORE program, I think it was called—where executives came in and did that, and I think it makes a lot of sense.

Mr. HONDA. Yeah.

BIS EXPORT ENFORCEMENT ACTIVITIES

Mr. WOLF. So we will take a look at it.

Your budget includes nearly \$111 million for the Bureau of Industry and Security. This amount is an increase of about \$9 million or nearly 9 percent that will largely support export enforcement activities. I am somewhat concerned that sensitive technology will make its way into the hands of unfriendly groups or nations.

Can you assure the committee and can you raise our comfort level with regard to that issue?

Secretary PRITZKER. Congressman—or Chairman, first of all the budget calls for about \$8.4 million to increase enforcement capability, analytics, and investigative capabilities for the 30,000 new items that we are responsible for under expert control reform. We are absolutely committed to making sure that we have tight controls on where our products are going.

And one of the things that we call for is additional funding also to have additional expert control officers in Turkey, in Germany, in the UAE so that we can have increased end-use checks in regions where we are concerned about trans shipment. These are places we think were vulnerable, and our budget have, I think, an additional \$2.6 million focused on that.

So we are very much focused on making sure that not only in our own capacity, but also working with our interagency counterparts, as well as the FBI to address any kind of vulnerabilities or illicit transfer of U.S. technology.

Mr. WOLF. We understand your Department's Chief Information Officer is stepping down. Obviously this is a crucial position. You and I have spoken about cyber security concerns. A recent IG report found that the Bureaus were not even following basic IT security practices.

Any comments about that?

IT LEADERSHIP AND CYBERSECURITY

Secretary PRITZKER. Chairman, I would say that my IT leadership needs an upgrade and so I am focused on making sure that we get the best quality individual in to lead. In the meantime, we have brought in the Chief Information Officer from NIST to help us run the Department's IT. We are going to run a national search to find someone, but we absolutely need the best quality person.

In terms of cyber security, I am absolutely committed to trying to get in place the best quality cyber security that we can. I am well aware of the threats as you and I have discussed, and you have made sure that I am well-educated on the issue and it is something that I take very seriously.

WEATHER SERVICE

Mr. WOLF. You are requesting increases for a number of programs across the Department, but one significant cut sticks out. You are recommending a \$45 million in the weather service.

Would you please provide us with your rational for cutting funding for weather forecasting activities?

Secretary PRITZKER. The weather service needs to go through an evolution, and if we continue to do the weather service the way

that we are doing the weather service today, we will be failing our users, and we need to begin to evolve the operations. And this is not a radical change, nor a wholesale change. This is an evolution.

What we want to do is to free up capacity to focus on the last mile of our services, so that we are getting high quality, consistent information into the hands of decision-makers, and what we are trying to do is really realign our budget at the weather service to increase transparency and alignment with our operation.

So, we have a number of things going on in the weather service budget. It is actually to improve the quality of what we are doing. For example, we are talking about centralizing some of our IT services, which we think is necessary to make sure that we provide a consistent service across the country. It allows for better quality assurance; it allows for better cyber security. Frankly, from business standpoint this is a best practice.

So, a part of what is happening with the weather service budget is a real evolution—the beginnings of an evolution towards better management, and frankly, taking advantage of the evolution of technology, too.

Mr. WOLF. Is there a team looking at that or is it just a few people within the Department—

Mr. PRITZKER. No. In fact, in our budget we suggest we create a Transition Office where we have a team dedicated to managing this evolution.

Mr. WOLF. Any people from outside of government?

Secretary PRITZKER. At this point, we are assembling the team and it will be a mix of people, both inside and outside.

SATELLITE LEADERSHIP

Mr. WOLF. We want to recognize Mary Kicza, your NOAA Assistant Administrator for satellites. We understand that she has announced her retirement. She has had a long and distinguished career at both NOAA and NASA. We thank her for her service. She has done yeoman's work.

What are your plans to fill that position? Probably one of the most crucial in the Department, particularly when you look at—you were not here—

Secretary PRITZKER. Yes.

Mr. WOLF. The history of the problems in the satellites. I mean, it has been an area that—

Secretary PRITZKER. Mr. Chairman, I am well aware of the challenges that have existed with the satellites. Mary's announcement to retire—first of all, I am grateful to her for getting us to a position where the satellites are today on budget and on schedule, and to managing through what was a difficult situation.

Under Secretary Sullivan and I are working closely hand in glove to try and identify someone to fill that position. I am assured by the Under Secretary that the team around Mary is strong enough to handle the situation in the interim while we fill that vacant position.

I appreciate, first of all, how significant the satellites are as a function in terms of providing information but, too, how important this part of our activity is and how sensitive it is, given the

vulnerabilities that exist within the satellite program, and our objective to try and deal with issues like the Gap, and other things.

So, I am deeply involved in trying to make sure that not only do we have the right personnel but that we don't lose the benefits of having to put the satellite program back, as the external group said, "back into good management," and I do not want to lose the fact that we are on schedule and on budget.

Mr. WOLF. Well, you have covered the Gap question, so that is not a position that has to be confirmed by the Senate, is it not?

Secretary PRITZKER. I do not believe so.

Mr. WOLF. Then you must move quickly.

Secretary PRITZKER. That is my hope, and Under Secretary Sullivan and I are on it.

Mr. WOLF. So, when do you think you would have it filled by? When is she leaving? When would she walk out of the door?

Secretary PRITZKER. I do not know the exact date she is leaving, but she is leaving in the next couple of months and we are in the process of beginning a search right now. When she told us we began the search. We are moving post-haste on this.

2020 CENSUS DEVICE TESTING

Mr. WOLF. Okay. On the census, the Subcommittee understands the census may employ a "bring your own device." If you can explain that to me a little bit, too. What does that mean, or what does that mean for ensuring security of the data that is collected on personal cell phones—but what does that mean?

Secretary PRITZKER. Well, it begins first by saying that we are going to use off-the-shelf technology. We are not looking—I believe the 2010 census at one point looked at creating its own technology. We are not going to do that, nor is it at all necessary, given the advancement in handheld devices.

The security of the census is something that is extremely important to us, and exactly how we deploy what kind of devices is part of the testing that we will do, making sure that information is secure and that we have the appropriate cyber security available to protect how we deploy in the field is something that is of high priority. This is part of what we are doing in the testing and the monies that we want this year.

Mr. WOLF. Bring your own does not mean everybody just has their own cell phone and they are going to kind of—

Secretary PRITZKER. Well, it may be that—I do not know. It actually does, but what the question is—you went right to the heart of the issue. How do we assure that we do not have vulnerabilities in terms of the data being at risk, right? And that is the most important thing, and this is all of what we are testing throughout the year.

Mr. WOLF. But look at Target. Look at Neiman Marcus. Look at—everyone takes their own. I do not know. To raise my comfort level and not answer when they call me. I refuse to—I might ask if—I think you are really, this is again, it was a great embarrassment the last time and there were problems, and I think you are going to have to be careful with this.

Secretary PRITZKER. Terrific. And, Chairman, I take very seriously the security and sanctity of what we are going to do, and the

data and being able to collect it. So this is part of what we are testing to see if it works. If it does not work, we are not going to do it.

AMERICAN COMMUNITY SURVEY

Mr. WOLF. The American Community Survey, over the last three years, amendments have been offered on the House Floor regarding the American Community Survey. One made compliance optional, the other prohibited use of funds to conduct the survey.

What is the Census Bureau doing to make this survey less intrusive for respondents?

Secretary PRITZKER. Well, we are doing a number of things, but let me back up a little bit. The American Community Survey obviously was a continuation of the long form survey. We have been reviewing top to bottom review of all of the questions on the American Community Survey. We are trying to reduce respondent burden because we are aware of its importance. The American Community Survey provides, as you know, important data and the frequency of it being updated is very important, not just to governments and their funding, but also to businesses.

So we need to balance how we reduce respondent burden. We are doing that by reviewing the questions to make sure that those questions are necessary and we have established a respondent who will advocate on behalf of the respondents.

Mr. WOLF. Is that new?

Secretary PRITZKER. Yes.

Mr. WOLF. So will that person be known? How will the word get out, or will that be under—

Secretary PRITZKER. We will get the word out. I do not know the specific ways that we will get the word out, but we will get the word out. And for the first group of questions, we will obtain feedback from federal data users by the end of May.

PATENT AND TRADEMARK OFFICE

Mr. WOLF. Okay. Patent and Trademark—in the budget request for the Patent and Trademark Office is \$3.4 billion, an increase of \$417 million, or nearly 14 percent. PTO has begun to divert fee collections into an operating reserve fund to provide it with a cushion for times when fee collections may be insufficient to sustain the PTO workforce and operational needs. In fact, the estimation is that their reserve will be \$800 million at the end of Fiscal Year 2014, and more than \$1 billion in Fiscal Year 2015, and the numbers in the out year continues to grow.

Will PTO be lowering its fees? One billion dollars seems more than excessive as an operating reserve. Has PTO established appropriate protocols to ensure that these funds, if and when they are spent, are spent wisely, and is there a plan to use this funding to work down the backlog or is there a number—like if I hit 1 billion one, we are going to stop? I mean, or is this going to be reserve, reserve, reserve?

Secretary PRITZKER. Mr. Chairman, first of all, as I mentioned earlier, the importance of having a reserve is so that we can manage through fluctuations and that we can assure the—

Mr. WOLF. Is that the largest reserve you have ever had?

Secretary PRITZKER. Yes. Having said that, we are looking at—now that we are building up a reserve that we think is—I do not know exactly what the right number is, but given the size of the reserve we are looking at whether we should consider lowering our fees or adjusting our fees now that we are achieving a significant sized reserve.

DEPARTMENT SENIOR LEVEL VACANCIES

Mr. WOLF. I think that would be a good idea. I am going to go one question of Mr. Fattah, and then back to Dr. Harris.

While Commerce has filled a number of positions over the last year, there are still a number of senior level positions at the Department that are vacant and filled with acting personnel. Deputy Secretary Pat Gallagher, who really—he was a good person. You lost—you should have gone out to his house and—

Secretary PRITZKER. I did. I begged. I was on my knees.

Mr. WOLF. And he is one of the most capable people that I think ever came before the Committee. I mean, he was really. Now, it is Pittsburgh's gain, but—

Secretary PRITZKER. And our loss.

Mr. WOLF. Yes, your loss. I mean, has he actually walked out of the building?

Secretary PRITZKER. June 12th, and he and I have been working on a transition plan and I have been working with the White House on his replacement, and I share with you that this is a big loss for us. And I have been working with him to make sure that we have the right leadership and, yes, that we have the right transition plan, that things do not fall through the cracks.

Mr. WOLF. Okay. But PTO, as Mr. Schiff mentioned, EDA, NOAA, CFO, no budget offer. I mean, they are really—because I will tell you, I used to work for a Cabinet Secretary. When all of those are vacant, I would—and if you noticed, I did not put you on the spot there. I did not ask if you knew or did not know anyone on this, but my best guess, I mean, you probably did not know—maybe you did, but you need your people there, and good people—

Secretary PRITZKER. Mr. Chairman, there is no one who wants their people there more than me, and I hope you might talk to your friends or colleagues in the Senate that I might get the folks through, the process there, and I have been doing everything I can with the White House to get people named and then through the process.

So I am totally—you and I are completely aligned on this and very focused.

Mr. WOLF. I think that is why some of the problems develop. Last year you had Acting acting, basically, and they were leaving. They did not really—so anyway, Mr. Fattah?

SKILLED WORKERS NEEDED

Mr. FATTAH. I represent Philadelphia, but to Pittsburgh's credit it has gotten two great leaders for two of its universities, the former head of the National Science Foundation is at Carnegie Mellon, and now Pat Gallagher is going over to the other great uni-

versity there. So it is a great win for—at least for the home state of Pennsylvania and a loss for the Federal government.

But I want to talk to you about this question of job openings, not in your Department, but in the country. The Administration posted a report from the Labor Department last month, saying that they are the highest number of openings ever—4.2 million job openings nationwide. There are companies in Pennsylvania, air products manufacturing and others, who have had job openings for over a year that they have not been able to fill.

We talk about MEP. One of the things that MEP does is they have a meeting with all of their local manufacturers. I went to one at 7:00 in the morning, and they go around the table and talk about their challenges. And to a person, every single one of them said that their number one challenge was finding qualified people who had the math skills and the other skills needed to work in their manufacturing plant.

I went out and visited a young lady out near southwest Philadelphia in Broomall. She has got a company called NK, and they make boutique electronics. So if you are a professional rower, or anyone who is interested in what is going on with the wind and speed—every tactical sharp shooter in the country probably uses one of her product. She has got a great company and she said she has not seen any recession. It is just growth each year, but hiring good people is a big issue.

And so I want to talk to you a little bit about—you know, because we talk about, you know, job creation each month, and it has been averaging around 200,000. But if there are 4.2 million jobs open in our economy, those are Americans who are not working. Those are incomes that are not being generated. These are companies that are not being able to meet their challenges or the opportunities in the marketplace as they see them. And, of course, it is slowing our economy.

So I know that this Administration, that you have a number of these interactions with other Department heads, I was wondering in your interactions with the Department of Labor, how you see the Nation being able to think anew about how to create more people who are not just unemployed, but who are job-ready.

Secretary PRITZKER. So, Congressman, first of all, the workforce training and skills development is something that is near and dear to my heart. Prior to taking this job, one of my major civic engagements was something I founded called Skills for America's Future, and then I founded an effort called Skills for Chicagoland's Future. And Skills for Chicagoland's Future was focused on the long-term unemployed, and your figures are precisely right—north of four million Americans—I mean, four million open jobs today.

In Chicago, we had 200,000 open jobs and 240,000 long-term unemployed, and frankly, addressing the long-term unemployed situation is a very serious question. We created, in Chicago, an intermediary to work between the businesses, made up of the Board of Directors of the 501C3, funded partially by the city, partially by the county, and partially by private foundations. And the job was to work between the employers in the region and the long-term unemployed, and what we found is there was actually a real bias against hiring the long-term unemployed.

Long-term unemployed is defined as being out of work for six months, and that the recruiting processes—it was not at the CEO level and it was not really even at the Chief Human Capital Officer level, but the recruiters basically felt that, why would I go and find someone who had been long-term unemployed to fill a job? I am just better off stealing from my competitor, if you will, and moving people around in the jobs.

And so we really addressed that by both addressing bias, but also working with the companies to say they will hire the long-term unemployed, and then we brought on-the-job training dollars to Baird to help those who needed re-training, and it has been enormously successful, a public/private partnership in Chicago that we created.

When I arrived here at this job, I made skills and workforce training one of the priorities of the Department of Commerce, and why do that? And it is not that we are spending big dollars. We do not have dollars to spend on it. But the business community needs to lead in job training, and the challenge that we face at the Department of Labor—and the Secretary of Labor completely understands this, and so he and I have been working hand in glove that business has to lead in terms of what do they need to fill the jobs that they have open.

And so I have been bringing the business community to the table to work with the Labor Department to try and redirect the dollars that the Labor Department is spending so the job training is focused on jobs that exist and jobs that will exist, as opposed to just as the Secretary of Labor would say, train and pray.

There is a significant effort that we have put forward and I think there are a number of tactics that can be applied to address this challenge.

Mr. FATTAH. Well, because I think as we sit here and we think about this, you know, if you had—if we could match up Americans with these four million jobs that are open, 4.2 million, right? Our economy would just—it would be vastly different than it exists today, but we need to do more in this area.

You know, it is fascinating to hear these manufacturers go around the room and talk about it, and in particular, Mr. Chairman, they talked about the fact that males of almost any type were a challenge in the workplace in terms of what normally in polite company we refer to as job readiness skills. They will either show up at work on time and be prepared to, you know, learn, because machinists in this manufacturing process have to—they are going to make a lot of mistakes early on, and they have to be able to stay on the job long enough to the point where they are producing more products that are correct than are incorrect.

NIST

So, anyway, it is an important area. I want to talk to you about NIST. Now, you have some \$600 million. I have worked with NIST. We did a number of important projects together. One, we had a signing here in the Capitol, which I was able to host between a European union and NIST. They had come up with joint standards, because as we see these economic groupings around the world, it is important if we are going to export that we have uniform stand-

ards with other markets. And so, Pat Gallagher did some great work in this regard. I am going to miss him.

But you talked a little bit about these manufacturing hubs or centers of excellence that are being set up. I think they are critically important, but we also need to have a broader pathway for other manufacturers to know about the resources of the Federal government. So beyond these centers we have our National laboratories, that are there to help businesses who have technological challenges, also done free of charge. A lot of our businesses, our manufacturers do not know that the National Lab infrastructures are there in place.

And I hope that as you lead the Commerce Department, Chicago has two of our National Labs right there—Argonne and Fermi—that we will do more to make sure that large and small businesses know about those resources that are available on behalf of our government to help businesses think through some of their challenges in a manufacturing space so that we can keep the advantages that we have.

Secretary PRITZKER. Absolutely. I think that getting the word out about the resources that the Commerce Department offers, whether it is in manufacturing or it is in exporting or different areas is one of the things that I am very focused on, because I find these are some of the best kept secrets in the country, which is crazy. We need to make sure that these resources are well understood.

Mr. FATAH. I will not recount the actual incident, but we had one very significant business in the process who had a challenge around batteries. Argonne is the leading experts in the world on batteries.

Secretary PRITZKER. Yes.

Mr. FATAH. We were able to marry them up and work out a problem that was very, very important for this American company to come to a better understanding around. But these resources are not as well known, and a lot of our businesses may think that there would be costs involved in it. In truth, a lot of our National Labs are there. We have a tremendous infrastructure in place—intellectual infrastructure in place to help businesses with these challenges.

So, I thank you. I yield back, Mr. Chairman.

Secretary PRITZKER. Thank you.

Mr. WOLF. Dr. Harris?

RECREATIONAL FISHING

Dr. HARRIS. Just very briefly. I am going to submit a couple of questions for the record. You know, my District is the Eastern Shore of Maryland and the suburbs of Maryland. The southern part that is on the coast is really a poor economy, so they do depend on the recreational and for-hire fishing fleets, and there is some concern, you know.

They are just great for the economy, those two sectors, and there is just some concerns about the estimates, like sea bass, and we are going to submit some questions—things like concerns with the changes in the sea bass size limits.

And again, I would just appreciate and I look forward to your answers on that, again because those industries are just so important to those economically depressed areas of the State.

Secretary PRITZKER. Well, Dr. Harris, I am well aware of how important that the recreational fishing is as an industry in general, and I would be happy to respond.

Dr. HARRIS. Thank you very much. I yield back.

Secretary PRITZKER. Thank you.

JOB CREATION IN AMERICA

Mr. WOLF. Thank you. I just have one comment at the end, and it is back to the Select USA, I hope you are going to look into this and call me, and I think that it is good that we encourage foreign companies to locate their manufacturing facilities in the U.S., but we need to ensure that Commerce is fulfilling its goal and working with U.S. companies to export their products.

The budget, though, is requesting a larger increase to support foreign direct investment, and not to place more foreign commercial service officers at our embassies overseas, and that is troubling. All you have to do is get on the train in Washington. I have family in Princeton, family in Philly, family in New York, and family in Connecticut and family all the way up to Boston.

You go through the neighborhood, you go by my old neighborhood, it is in decay. The factories are closed. The windows are broken. The graffiti is on the walls. The weeds are growing out, and we were a manufacturing base, and if you look at what is taking place in China—the pollution, the corruption—and I am sure you are going to be at the conference that we have.

Secretary PRITZKER. Yes, of course.

Mr. WOLF. But I think it is important because we compete. We can.

Secretary PRITZKER. Absolutely.

Mr. WOLF. We can, and I think it is great if we can get a company from the Netherlands to come. I am all for that. And I am glad the VW one that you mentioned, my first car was a VW. I bought it in a little used car dealership up in his District, up on North Broad Street. But I want American made.

Secretary PRITZKER. Yes.

Mr. WOLF. And it is almost insulting to the American worker to say that we cannot make things. And, you know, the Administration put this guy, Jeff Immelt, head of GE, who took jobs out of America to be in—he was a disaster. He was the guy taking jobs out. He took a large facility from Winchester, and anyhow, so you can be like Esther in a bottle for such a time like this, and I think you have a very, very unique background. I am not overly thrilled with this Administration, but I think your appointment is a good appointment, and I think you understand, coming to visit.

This can be—not that you are going to solve the problem for the rest of your term, but you can begin to turn this around. And so we want to bring these jobs back. If an American company is abroad and their plant manager and CEO is working and he gets in trouble, or gets kidnaped, he doesn't call the Mexican police or he doesn't call the English police. He doesn't call the—he calls the FBI.

Secretary PRITZKER. Right.

Mr. WOLF. And so, anyway, I think this is really important that we do this. The Committee appreciates your testimony. We will look forward to working with you as we mark up the Bill and do everything that we can to help you be one of the most successful. One of my former bosses was the Secretary of Commerce—Rogers C.B. Morton. I worked for Secretary Morton, who represented the Eastern Shore, where Dr. Harris was from. He left—I worked for him at the Department of the Interior, then he left and went over and became the Secretary of Commerce. And in many ways, they were big shoes to fill. He was a big man. He was about six feet eight, something like that.

But we want to help you do well so that we can create more jobs for Americans, and unless you have any closing comments, we will just kind of end now.

Secretary PRITZKER. Mr. Chairman, I have no further closing comments except to say thank you very much, and I share your passion for creating jobs and having American businesses grow and made in America. Thank you.

Mr. WOLF. Thank you. The hearing is adjourned.

Secretary PRITZKER. Thank you.

The Honorable Chairman Frank Wolf
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on Department of Commerce FY 2015 President's Budget Request

NOAA SATELLITES

Question: What is the Life Cycle Cost estimate for the Joint Polar Satellite System program?

Answer: The current (FY 2015 President's Budget) Life Cycle Cost estimate for the JPSS program is \$11,323.4 million.

Due to proposed changes to the NESDIS organizational and budget structure in the FY 2015 President's Budget, there is an adjustment to the total amount of the JPSS LCC attributed to the JPSS PPA. Dependent on final FY 2015 appropriations, this restructure would transfer a total of \$25.6 million through 2025 from the JPSS program to two new PAC enterprise offices of Satellite Ground Services and Systems Architecture and Advanced Planning. Due to this transfer, the total amount of the JPSS LCC attributed to the JPSS PPA is adjusted from \$11,349.0 million to 11,323.4 million. This adjustment does not impact the program's launch commitment dates.

Question: Please list the fiscal year, quarter, and month of the expected launch date of JPSS-1 and JPSS 2.

Answer: The table below shows the expected launch readiness dates of JPSS-1 and JPSS-2.

Spacecraft	Launch Commitment Date
JPSS-1	No later than Q2 FY 2017
JPSS-2	Q1 FY 2022

Question: Please list each sensor planned for JPSS-1 and JPSS-2 and denote whether it fulfills a NOAA operational or NASA research mission.

Answer: The table below lists the spacecraft instruments on JPSS-1 and JPSS-2 and specifies the missions they serve.

JPSS-1 Sensors	NOAA Operations or NASA Research Mission*
Advanced Technology Microwave Sounder (ATMS)	Required for NOAA's operational mission. Also used in NOAA/NASA research.
Cross Track Infrared Sounder (CrIS)	Required for NOAA's operational mission. Also used in NOAA/NASA research.
Visible Infrared Imaging Radiometer Suite (VIIRS)	Required for NOAA's operational mission. Also used in NOAA/NASA research.
Ozone Mapping and Profiler Suite-Nadir (OMPS-N)	Required for NOAA's operational mission. Also used in NOAA/NASA research.

Cloud and Earth Radiant Energy System (CERES)	Both NOAA and NASA research missions
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* Note: Data from all sensors are used at NOAA, NASA, and other Federal agencies and academia for research purposes that improve use of the data in support of operations.

JPSS-2 Sensors**	NOAA Operations or NASA Research Mission*
Advanced Technology Microwave Sounder (ATMS)	Required for NOAA's operational mission. Also used in NOAA/NASA research.
Cross Track Infrared Sounder (CrIS)	Required for NOAA's operational mission. Also used in NOAA/NASA research.
Visible Infrared Imaging Radiometer Suite (VIIRS)	Required for NOAA's operational mission. Also used in NOAA/NASA research.
Ozone Mapping and Profiler Suite-Nadir (OMPS-N)	Required for NOAA's operational mission. Also used in NOAA/NASA research.

* Note: Data from all sensors are used at NOAA, NASA, and other Federal agencies and academia for research purposes that improve use of the data in support of operations.

**NOAA could provide accommodations on JPSS-2 for the OMPS-L instrument (currently flying on Suomi NPP) and the Radiation Budget Instrument (RBI, successor to CERES), to be provided by the NASA Earth Science Division in the Science Mission Directorate, on a no-impact basis to NOAA's weather mission if acceptable agreements with NASA are concluded.

NOAA has begun efforts to procure additional long-lead items to build in redundancies to the JPSS mission.

Question: What sensors is NOAA including in this effort; how many copies; when will they be complete; and how long will it take to integrate them onto a new platform should Suomi NPP or JPSS-1 fail for any reason?

Answer: Because the Advanced Technology Microwave Sounder (ATMS) and Cross-Track Infrared Sounder (CrIS) instruments provide data that is critical to accurate and timely weather forecasts, NOAA is pursuing a robust spare parts strategy for the ATMS and CrIS instruments to protect the JPSS-2 schedules. NOAA plans to procure two sets of critical spare parts for both the CrIS and ATMS instruments. These spares consist of one set that will be built into a backup set of "line replaceable units (LRUs)" or sub-assemblies. The other set is key parts to back up the LRUs. This sparing strategy is based on experience with Suomi NPP (SNPP) and JPSS-1.

Contract negotiations are underway for the build of the JPSS-2 instruments. The contracts' scope will include procurement of the critical spare parts for CrIS and ATMS. The build schedules will

be available once the JPSS-2 instrument contracts are definitized. JPSS is committed to seeking the best schedules practicable.

Question: What other platform has NOAA identified to serve as a launch vehicle should that scenario develop?

Answer: The Department recognizes the need to build robustness into the JPSS program to maintain observations in the event of a loss of a satellite in the afternoon polar orbit. The formulation and acceleration of follow-on missions is a critical component of NOAA's strategy to reduce the likelihood of a gap in satellite data through a more robust JPSS architecture. NOAA is looking at recommendations made by the NESDIS Enterprise Independent Review Team's (IRT) for a robust polar follow-on program.

NOAA-GOES R

Question: What is the Life Cycle Cost estimate for the Geostationary Operational Environmental Satellite R series?

Answer: The current (FY 2015 President's Budget) Life Cycle Cost estimate for the GOES-R series is \$10,829.5 million.

Due to proposed changes to the NESDIS organizational and budget structure in the FY 2015 President's Budget, there is an adjustment to the total amount of the GOES-R Series LCC attributed to the GOES-R Series PPA. Dependent on final FY 2015 appropriations, this restructure would transfer a total of \$181.1 million through FY 2036 from the GOES-R Series program to three new PAC enterprise offices of Satellite Ground Services, Systems Architecture and Advanced Planning and Projects, Planning and Analysis. Due to this transfer, the total amount of the GOES-R Series LCC attributed to the GOES-R Series PPA is adjusted from \$11,010.7 million to 10,829.5 million. This adjustment does not impact the program's launch commitment dates.

Question: Please list the fiscal year, quarter, and month for each the expected launch dates of GOES-R, S, T, U.

Answer: The table below shows the expected launch readiness dates of GOES-R, S, T, and U.

Spacecraft	Launch Commitment Date
GOES-R	Q2 FY 2016
GOES-S	Q3 FY 2017
GOES-T	Q3 FY 2019
GOES-U	Q1 FY 2025

Question: Please list each sensor for each satellite, GOES R, S, T, and U, and denote whether it fulfills a NOAA operational or NASA research mission.

Answer: The table below lists the spacecraft instruments on GOES R, S, T, and U and specifies the mission they serve.

GOES-R, S, T and U Spacecraft Instruments	NOAA Operations or NASA Research Mission
Space Environment In-Situ Suite (SEISS)	Required for NOAA's operational mission
Advanced Baseline Imager (ABI)	Required for NOAA's operational mission
Geostationary Lightning Mapper (GLM)	Required for NOAA's operational mission
Solar Ultraviolet Imager (SUVI)	Required for NOAA's operational mission
Extreme Ultraviolet and X-ray Irradiance Sensors (EXIS)	Required for NOAA's operational mission
Magnetometer	Required for NOAA's operational mission

INTERNATIONAL TRADE ADMINISTRATION

Question: Does Commerce anticipate that it will meet or exceed the National Export Initiative goal of doubling exports by the end of 2014?

Answer: The National Export Initiative has been catalytic. Thousands of companies across the country made exporting a strategy to growing their business. Dozens of states and communities turned to exports as a path for economic growth to support additional jobs. We should and must remain vigilant to maximize the potential of our free trade agreements and of every American company that wants to grow, compete, and hire through exporting.

American businesses achieved record exports for four consecutive years, with exports supporting a record 11.3 million jobs in 2013. Starting from a base of \$1.8 trillion of exports in 2009, the United States has reached an all-time high of \$2.3 trillion in 2013.

Building on progress of the National Export Initiative, Secretary Pritzker announced NEI/NEXT in mid-May to improve Federal information resources that will help American businesses capitalize on existing and new opportunities to sell Made-in-America goods and services abroad.

The five objectives of NEI/NEXT are rooted in the lessons we have learned and include:

1. Connecting more U.S. businesses to their next global customer with tailored industry-specific information and assistance.

2. Making the next international shipment easier and less expensive, through efforts to streamline U.S. government export-related services, reporting requirements and processes, and speeding American goods to more markets through domestic infrastructure improvements.

3. Expanding access to finance for U.S. businesses' next export transaction, helping more exporters obtain financing to meet international demand, and ensuring more companies know what products and services are available to reduce risk and export to new markets with confidence.

4. Promoting exports and foreign direct investment as the next economic development priorities in communities and regions across the country by enhancing partnerships with local and state leaders and by coordinating with SelectUSA.

5. Creating, fostering and ensuring U.S. business' next global opportunity by helping developed and developing economies improve their business environments, by opening new markets, and by establishing conditions and addressing barriers to allow more American exporters to compete and win abroad.

The United States is poised to capitalize on an increasingly favorable global macroeconomic outlook, and through NEI/NEXT we will continue to support economic growth and create opportunities for U.S. businesses and the American workforce to sell Made-in-America goods and services to more countries.

Question: What is the current status of the ITA reorganization?

Answer: The reorganization of ITA offices was implemented on October 1, 2013. All staff have been reassigned into offices within the new three business unit organizational structure.

Question: How many staff are assigned to headquarters and how many staff are forward deployed to either the domestic or foreign field?

Answer:

International Trade Administration			
Position Count			
	FY 2013 Actuals	FY2014 Current	FY 2014 Plan (EOY)
Overseas Staff ¹	191	191	207
Locally Engaged Staff ²	745	753	845
Domestic Field ³	283	290	321
HQ (HCHB & Reagan Building) ⁴	901	879	949

Training Complement	18	18	25
	2138	2131	2347

¹ Overseas Staff included traditional Foreign Service Personnel and Limited Term appointments supporting Enforcement and Compliance Activities. On 19 May, Global Markets swore in 24 new officers and is progressing toward its end-of-year plan.

² Locally Engaged Staff includes all Foreign Nationals that support Global Markets or Enforcement and Compliance Activities.

³ Domestic Field and HQ Staff numbers include traditional Foreign Service Personnel that are in domestic rotation.

⁴ FY 2013 Actual and FY 2014 Current figures represent only filled positions, while the EOY plan represents all hiring anticipated to be completed by the end of this fiscal year. HQ figures for FY 2014 reflect elimination of 45 positions from the consolidation of business units.

CENSUS

Question: During which quarter and fiscal year will the Census bureau determine when it will commit to a "bring your own device" model for conducting the 2020 decennial census?

Answer: We will make this decision, including understanding the budget, policy, security, and accountability implications, by the end of FY 2015 as part of our major design decisions. Understanding how much of the workforce can use their own device or would need Government Furnished Equipment (GFE) will continue to be studied into FY 2016 and FY 2017. To permit final decisions about the execution of bring your own device (BYOD) closer to the beginning of field operations, we are building data collection tools that will run on either consumer grade GFE or BYOD.

Question: What cost savings have been realized from the regional office reorganization?

Answer: As part of the Census field realignment, we consolidated our physical infrastructure and at the same time established more work-at-home positions. In so doing, we greatly increased the span of control for our remaining six offices. We are accomplishing the same amount of data collection work with fewer managers, supervisors, and administrators supporting our nation-wide survey interviewing workforce. As a result, we lowered annual spending by over \$2 million in leasing costs and over \$5 million in staff costs. In addition, we are analyzing our costs for future years, and preliminary estimates indicate that we may be able to lower annual spending still further.

Question: Does the Census Bureau possess the necessary human capital/skill sets to conduct the research and testing needed to inform the 2020 Census design?

Answer: Yes, the Census Bureau has the skills needed to conduct the research and testing for 2020 design. We are pulling in these skills from a variety of sources, including employees, contractors, and outside expert advisors. We recently put in place a comprehensive strategic workforce planning effort with a special emphasis on identifying our capabilities in areas crucial

to the successful modernization of the 2020 Census. Census Bureau managers and employees executed a skills assessment in 2013, in order to identify gaps or areas where an additional focus is needed to strengthen specific competencies and technical skills. The results of the assessment confirmed that we can support the critical tests with the combination of employee, contractor and advisor support currently in place. In addition, the 2020 Census program managers have prepared workforce action plans with strategies and timeframes for closing gaps that we identified for future activities. These strategies include additional targeted hiring, training and contractor support, and continued use of outside experts from the private sector and academia. Our FY 2014 funding level has enabled us to move forward with key, high priority activities; that is, we are filling vacancies and have brought staff from other areas of the Census Bureau to assist as subject matter experts. Looking ahead to first half of FY 2015, funding for staffing and contractor support will be essential. We must have the right resources on board to conduct the most critical testing to support the design decisions. Completing the execution of the action plans for the 2020 Census workforce in 2014, and continuing to hire and contract for the right skills at the right time are critical to successfully advance the program and conduct essential field tests in FY 2015.

Question: What potential legal obstacles has the Census Bureau identified related to the various design options under consideration and what is your plan and timeframe for overcoming these challenges

Answer: The main challenge we have identified is gaining access to certain administrative records that we currently cannot access. Reusing information that taxpayers have already supplied to the government is a key element in our plans to save money in the 2020 Census. That is, if people do not want or are unable to respond to the census either on the internet, on paper, or over the telephone, we will need to visit their homes in person. We are researching two key strategies related to nonresponse: 1.) Using other government records as an alternative to visiting the homes of nonrespondents and 2.) using other government records to identify vacant units and remove them from the non-response follow-up universe. The Census Bureau currently has authority to use many sets of government records for statistical purposes, and has used such records in the past (for example, to enumerate members of the military stationed overseas). However, in order to maximize cost savings and maintain data quality, we would like access to additional record sets, such as components of the National Directory of New Hires. While the Census Bureau has agreements with each of the states to acquire the Unemployment Insurance of the NDNH, these state-level agreements were written for the Longitudinal Employer-Household Dynamics program and do not permit other uses, including the decennial census. Aside from access to these record sets, we have not identified other major legal obstacles to the various design options under consideration. However, we have established a Legal and Policy Team. The role of the team is to examine questions, issues, and risks raised by our research teams, managers, and other stakeholders and determine if they might require a change to an existing Census Bureau policy, a legal review, or even the need to pursue a change in existing law. As it makes its determinations, the team will work with the leadership of the Census Bureau, Economics and Statistics Administration, Department of Commerce, and the Office of Management and Budget to elevate the discussion and pursue further action on these matters as necessary. We also are briefing Congress regularly on the innovations under development, and we are working closely with our oversight and appropriations committees to identify and address legal or regulatory issues that surface.

**The Honorable Representative Andy Harris
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on Department of Commerce FY 2015 President's Budget Request**

CROWD SOURCE BATHYMETRY

Question: What is NOAA doing to explore the use of Crowd Source Bathymetry as a means to supplement more expensive multi-beam surveying?

Answer: NOAA's Office of Coast Survey routinely uses crowd-sourced hydrographic data in charting. Many of the soundings on NOAA charts in remote areas are from trackline depths provided to NOAA from transiting vessels – i.e., not as part of an organized hydrographic survey. NOAA has a partnership with the U.S. Power Squadron and the U.S. Coast Guard Auxiliary to provide NOAA with bathymetric data and informal surveys in areas of rapid change in coastal areas. More recently, NOAA has signed an agreement with ActiveCaptain – a crowd-sourced cruising guide that collects navigation hazard reports from the public. These data and reports enable NOAA to focus its surveying and charting efforts on areas that are known to have changed and are of concern to mariners. In cases where there is credible evidence of a hazardous situation, the data and reports are used directly as a charting source.

In addition to these ongoing efforts NOAA is pursuing new approaches to increase the availability of depth data, including:

- Establishing a network of "trusted partners," such as U.S. Coast Guard vessels in remote areas, capable of acquiring depth data with known accuracy.
- Applying an integrated mapping approach on other NOAA Fleet missions, such as deploying certified hydrographic survey equipment on NOAA Fisheries vessels and providing training to operate that equipment.
- Co-funding surveys with other authorities, such as State agencies, if those non-NOAA surveys will be done to NOAA standards and by qualified hydrographers.
- Working with the U.S. Coast Guard to outfit their vessels with qualified survey equipment and train Coast Guard personnel in the use of that equipment for limited reconnaissance surveys.
- Transitioning new survey technologies to operations, including airborne laser bathymetry, satellite bathymetry, interferometric sonars, advanced multibeam data processing, autonomous underwater vehicles, and bathymetric radar.
- Working with the International Hydrographic Organization and NOAA's National Geophysical Data Center to build a crowd-sourced bathymetry database to serve as a repository for crowd-sourced data globally.

The main challenge associated with implementing crowdsourcing initiatives is ensuring the quality of crowdsourced data. It is also important to note that crowd-sourced bathymetry, even in large quantities, is not a substitute for a hydrographic survey, especially in areas of critical under-keel clearance. A controlled survey is designed to address all the soundings and features on the chart – such as finding and establishing a least depth on rocks, wrecks and obstructions;

disproving older data; and accurately depicting safe water. Despite these issues NOAA welcomes and receives the public's interest in crowdsourcing hydrographic data, which highlight the importance of maritime informational infrastructure – such as nautical charts – for safe and efficient marine transportation.

Question: What is NOAA's anticipated timeline to implement the use of Crowd Source Bathymetry as part of their production surveying budget, and can you provide this committee with your implementation plan?

Answer: At this time NOAA has no formalized timeline or implementation plan to share with the Committee regarding the aforementioned efforts to implement new crowdsourcing approaches. Some of these efforts are already well underway, such as working with the Coast Guard to obtain reconnaissance bathymetry in Alaska or using airborne laser bathymetry for hydrographic surveying, while other efforts are in the early stages of development.

CATCH SIZE LIMIT

Frequent and increasingly restrictive changes in the size limit for sea bass are a concern for many of my constituents: Since 1997, the size limit has increased 5 times. Apparently published too late in the Federal Register for '96, management reportedly began in 1997 with a 9 inch limit. In 1998, the size limit went up 1 inch for a 10 inch size limit, in 2001 the size limit was set at 11 inches, 2002 was 11.5, 2003 was 12 inches, and in 2009 the size limit increased to 12.5 inches. My understanding is that spawning typically occurs by 8 inches in size, and while sex reversal may occur in some sea bass, (roughly 38% of which are hermaphroditic) most fish 8 inches and below are female. These ever changing and ever tightening restrictions have consequences – both economically and on the credibility of the size limit.

Question: Please explain the changes in the size limit.

Answer: The minimum fish size for recreational black sea bass changed several times from 1997 until 2003. In the past 11 years, however, there was only a single half-inch increase in 2009. 12.5 inches has remained the minimum size for the past 5 years. Because of a concern for stock dynamics, the Mid-Atlantic Fishery Management Council and the National Marine Fisheries Service (NMFS) have not implemented a larger minimum size, and have primarily used reductions in season length to manage the recreational black sea bass fishery in recent years.

According to the most recent stock assessment conducted by NMFS' Northeast Fisheries Science Center in 2012, only about half of the black sea bass are sexually mature at 8 inches. However, all black sea bass are believed to be sexually mature around 12 inches. In addition, because we believe that only about 15 percent of recreationally discarded black sea bass die, the current minimum fish size allows us to ensure that the majority of these fish are able to spawn at least once before becoming vulnerable to the fishery.

The Honorable Representative Mario Diaz-Balart
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on Department of Commerce FY 2015 President's Budget Request

U.S. CUSTOMS AND BORDER PROTECTION

The Administration launched the National Travel and Tourism Strategy in 2012 to make America a more attractive and accessible destination. The Strategy sets a goal of drawing 100 million international visitors by 2021. Florida is already a major destination for international visitors. However, U.S. Customs and Border Protection (CBP) staffing at many ports of entry, specifically at Miami International Airport (MIA), have been unable to meet the demands of international travelers. This year, there are six new international airlines starting service at MIA and there are currently ongoing discussions with eleven airlines for new service to MIA. Additionally, five existing MIA air carriers are planning on expanding service for the 2014 World Cup in Brazil and the Rio de Janeiro Olympics in 2016. This and other data clearly shows that an influx of international visitors will be coming through MIA and other U.S. ports.

Question: Although CBP staffing is not handled at Commerce, what is the Department doing to prepare and plan for the increase of international travelers and help reduce burdensome wait times that could impact future visits to the U.S.? How will CPB staffing impact the strategy's goal of attracting 100 million international visitors?

Answer: On May 22, 2014, President Obama issued a Presidential Memorandum on Establishing a National Goal and Developing Airport Specific Action Plans to Enhance the Entry Process for International Travelers to the United States. The Memorandum directs the Secretary of Commerce and the Secretary of the Department of Homeland Security to work together to develop a national goal for improving service levels for international arrivals, and specific action plans for at least 15 U.S. gateway airports, to ensure progress. The Department of Commerce is working to ensure that private-sector perspectives are taken into consideration as we work with DHS to identify solutions. The Department is also encouraging the development and expansion of effective public-private partnerships.

Commerce is providing assistance in forecasting data on arrivals to better inform staffing plans for DHS. Working together to get this right will help ensure a positive experience for visitors entering the country, which, in turn, affects the positive perception of the United States as a travel destination. Positive perception is necessary to meeting the goals of the Strategy of welcoming 100 million international visitors by 2021.

During the hearing, Secretary Pritzker mentioned an inter-agency initiative that is being worked on to bring down the CBP wait times.

Question: Can you provide the Committee with additional details on this initiative? How does the initiative envision reducing wait times? Will a set of recommendations be released, and if so, do you expect to request funding to achieve these goals? Will the inter-agency initiative

consult and seek suggestions from outside stakeholders, including airports and local governments?

Answer: On May 22, 2014, President Obama issued a Presidential Memorandum on Establishing a National Goal and Developing Airport Specific Action Plans to Enhance the Entry Process for International Travelers to the United States. The Memorandum directs the Department of Homeland Security (DHS) and the Department of Commerce to work together to develop a national goal for improving service levels for international arrivals. As part of the process, the Memorandum calls for the development of specific action plans for at least 15 U.S. gateway airports, to ensure progress.

DHS's role in processing visitors efficiently, consistent with U.S. security objectives, is critical to the success of the National Travel and Tourism Strategy. DHS's ability to meet these objectives affects perceptions of the United States as a travel destination. The solutions to mitigate wait times vary by airport and are in the purview of DHS and their partners. It is anticipated that the process will fully engage outside stakeholders, including local areas of government and the private sector in the development of the 15 airport specific action plans, which are envisioned to include activities to improve the entry process by both the public and private sectors. The report will go to the President at the end of September. Funding requests, if any, would come from DHS.

TRAVEL, TOURISM, TRADE

During the hearing, Secretary Pritzker mentioned a set of principles in terms of commitment to travel, tourism and trade between Commerce and DHS to work closely together. She mentioned these principles were just announced the day before the hearing

Question: Can you provide the Committee with additional details on these principles? Will they be released to the public? During the formulation of these principles, were outside stakeholders, including airports and local governments, consulted and asked for input?

Answer: The principles were published publicly in a May 9, 2014, blog post authored by Secretary Pritzker, available at <http://www.commerce.gov/blog/2014/05/09/commerce-and-department-homeland-security-new-partnership-built-shared-principles>. As excerpted from that post, the principles are:

- Security and trade are mutually reinforcing. Commerce and public safety are mutually reinforcing. Promoting the secure and legitimate flow of goods and people—and focusing our resources on preventing the illegal movement of people and goods that pose a potential threat to our citizens, businesses, and our way of life—is good for our economy and our security.
- The private sector is a crucial partner in our shared goals of security and economic competitiveness. Government programs and policies that affect the private sector are more effective when designed in collaboration with affected stakeholders—and better

executed when they appropriately tap market forces to encourage private investment in public goods.

- The public deserves integrity and good service from its government. Competent, efficient, and responsive service must be a priority in all programs that involve direct interaction with the public. Good service facilitates compliance with laws and regulations, eases burdens on people and businesses, enhances the value provided to the nation, and promotes trust in government.

The departments are working together on policies aimed at ensuring that our nation remains safe and that we are facilitating trade in goods and services, including travel and tourism.

The principles were developed in response to previously provided input from outside stakeholders, including airports, local governments and the private sector, and will serve as the basis of our collaboration in responding to the Presidential Memorandum on Establishing a National Goal and Developing Airport Specific Action Plans to Enhance the Entry Process for International Travelers to the United States.

The Honorable Representative Adam Schiff
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on Department of Commerce FY 2015 President's Budget Request

PTO INFORMATION TECHNOLOGY SYSTEMS

All users of patent information rely on the high quality databases of U.S. patent information currently published by the Patent and Trademark Office (PTO). There is a connection between the quality of the PTO databases – used internally and publicly disseminated – and the quality of results that come out of the examination process. A few years ago, Former Director of the USPTO David Kappos made a commitment to this Subcommittee that as the USPTO upgrades its information technology (IT) systems at the agency, it will maintain or improve the quality of the PTO databases and make sure that quality is not degraded in the upgrade process.

Question: Since the agency is still undergoing an upgrade of its IT systems, can you make that same commitment to this Subcommittee?

Answer: Yes, the USPTO remains committed to maintaining and improving the quality of its publically available information and internal and external databases. Any upgrades that would impact the current patent publication process will meet or exceed the existing standards. The goal of the IT System improvements is to have the stakeholder, applicant or examiner capture the data accurately the first time and, therefore, reduce the need for machine or manual intervention. Intermediate steps toward this goal will look at automated and manual solutions to capture data, not just at publication but during the entire lifecycle of a patent application.

The IT System improvements, to date, give Patent Examiners some structured text in active patent applications versus a reliance solely on images of the documents. As of April 2014, there are over 110 million pages of structured text available to assist Patent Examiners in their extremely time sensitive examining duties. The IT System improvements have also added databases with translation of foreign language data for both the Patent Examiners and the public to search in order to determine patentability.

Question: Can you provide an update on the progress PTO has made in upgrading its systems?

Answer: The USPTO has made significant progress in upgrading its IT systems. Improvements have focused on developing patent examination tools and the new infrastructure that supports them. These tools will allow patent examiners to view their docket of patent applications and the content of the applications; search patents and other documents to establish patentability; and, author a response to the patent applicant. USPTO's IT systems provide patent examiners more intelligent data; additional patent collections to search; and a new classification system, Cooperative Patent Classification (CPC), which is shared with foreign Intellectual

Property Offices. The CPC system improves the cataloging of applications and patents which allows the public and patent examiners to more easily find technologies associated with those documents.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY/MANUFACTURING EXTENSION PARTNERSHIP

We still have the most productive workforce in the country, and I believe we should invest in programs that help keep manufacturing jobs in the United States. One of those programs is the Manufacturing Extension Partnership which helps small and medium sized manufacturers – and there are a lot of them – grow into new markets and tap into technologies that can make them more productive and able to employ more workers.

As you know, the cost share required of the Manufacturing Extension Partnership (MEP) has been of primary concern to the MEP nationwide network, and particularly in California. Currently, the MEP program has the highest cost share ratio of any Commerce Federal assistance program. In November 2012, this Committee asked the Department to report on its plans regarding MEP cost share reduction. Although no Department report has been received to date, I understand there have been advisory reports that have supported the cost share reduction.

Question: Does that Department continue to believe that it doesn't have the authority to make that change under existing language?

Answer: Yes, the Department's legal counsel had advised the program that the language only allows a change in cost-share based on findings in the GAO report. The GAO report, Factors for Evaluating the Cost Share of Manufacturing Extension Partnership Program to Assist Small and Medium-Sized Manufacturers, did not provide specific recommendations about cost share, therefore the Department could not implement any change in the current cost share structure. The program continues to believe a change in cost-share would make the system more effective and efficient.

Question: Can you speak to the MEP program and its impact?

Answer: The MEP program works to address manufacturers' most pressing issues and position companies for growth and improved competitiveness. In FY2013, MEP served over 30,000 manufacturers and the work of program continues to produce impressive results. Economic impacts reported by clients receiving services in FY2012-2013 include:

New and Retained Sales of \$8.2B

Cost Savings of \$1.2B

New Investment of \$2.5B

Jobs Created and Retained 62,703

Question: Do you believe it has been an effective investment?

Answer: Yes. The MEP program impacts identified above are captured through a client survey process that has been characterized by OMB as the "gold standard" for evaluating business assistance programs. This process involves a quarterly survey of all MEP clients served, administered by an independent third-party. Historical response rates for this survey have exceeded 80%. Attribution of the impacts can be directly linked to MEP due to the formatting of questions that ask "As a result of services received from (MEP Center) over the past 12 months, did you _____ (increase or retain sales, add jobs, reduce costs, make new investments)."

In addition, the MEP program utilizes independent reviews to evaluate the effectiveness of the investment beyond the magnitude of impacts reported in the client survey. The most recent meta-analysis of the program and the reviews of its effectiveness was begun in 2011 by the National Academies' Board on Science, Technology, and Economic Policy. The report, 21st Century Manufacturing: The Role of the Manufacturing Extension Partnership Program released in October of 2013 included a statement that "Multiple assessments of MEP find that the program has a positive net impact," and noted that these assessments included over 20 academic reviews conducted during the past decade as well as analysis, case studies, and interviews conducted specifically for this National Academies study.

Question: If the Committee were to include technical language in its FY15 CJS bill clarifying the cost share reduction, would the Department support it?

Answer: Yes, as indicated in the Administration's budget request for FY 2015, "...the Administration urges Congress to consider the potential benefits of adjusting the cost share requirement from the current 2:1 ratio of non-Federal to Federal funds in order to provide greater flexibility and incentives to develop innovative tools, increase service to young, entrepreneurial rural firms, and secure greater impact and accountability."

**The Honorable Representative Honda
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on Department of Commerce FY 2015 President's Budget Request**

NIST

Question: How do you anticipate NNMI funding will support our domestic manufacturing future and the impacts you anticipate on tomorrow's workforce and job market?

Answer: The NNMI is an investment in the Nation's manufacturing future. As stated by the non-partisan Council on Competitiveness, "U.S. manufacturing is more important now than ever," with "enormous opportunities to increase production and grow exports". These opportunities are especially ripe due to the digital, biotechnology, and nanotechnology revolutions.

This investment in the future of manufacturing will make it easier (less costly *and* less risky) for manufacturers to do scale-up to mass production of the laboratory innovations for which the U.S. is so famous. Our competitor nations have such programs to scale up U.S. and other innovations to commercial production, and have had enormous commercial success in production and exports of U.S. innovations such as lithium batteries and solar cells, markets in which the U.S. has virtually no activity. Among our competitors, the German Fraunhofer program is the world's most established and premier manufacturing research program, and has served them well in maintaining Germany as a strong manufacturing powerhouse with high wages and continued positive trade balance. In contrast, from 2001 the U.S. deviated from our historic norm of strong trade surplus in advanced products to an unprecedented trade deficit, losing one-third of our manufacturing workforce. These all-important products are critical not only for the economic impact, export benefit and significant jobs benefit, but also for the innovation benefit for the next generation of products and services. As the U.S. National Academy of Engineering observed, if the U.S. desires to sustain leadership in design and innovation, maintaining capability in advanced manufacturing is essential.

In addition to providing the one-time seed funds for Institutes to stimulate the development of strong, modern manufacturing sectors in the U.S., the NNMI institutes all have a significant workforce training component to prepare both new workers and returning veterans for jobs in advanced manufacturing. These are good quality jobs with high pay, but currently U.S. manufacturers cannot find enough workers with the required skills; NNMI will help address that talent shortage.

Question: Please keep us apprised of Commerce Department efforts to connect investors with economic development communities and encourage more foreign direct investment. What third party groups are you working with to try to connect American businesses with foreign customers?

Answer: Through the ExporTech initiative, MEP is helping companies enter or expand in global markets. The program assists participating companies in developing an international growth plan, provides experts who will vet their plans, and connects the companies with

organizations like yours that will help them move quickly beyond planning to actual export sales. ExporTech is deployed nationally as a collaboration between the MEP, U.S. Export Assistance Centers, and other partners including District Export Councils, State Trade Offices, Ex-Im Bank and SBA. These partners help to recruit participants, line up speakers, and in many cases, serve as speakers themselves in the ExporTech sessions. To date over 500 companies in 28 states have participated in the program. Average sales increased/retained per company is \$770,000 with about \$50,000 in cost and investment savings reported.

ITA

SelectUSA

Question: How will the \$20 million in this request enable SelectUSA to effectively re-shore and bring job-creating investment to the United States?

And how can we improve how we track and measure the efficiency of these investments?

Answer: Business investment, including foreign direct investment (FDI), plays a vital role in supporting U.S. jobs and helping to bolster U.S. export competitiveness. For instance on FDI, U.S. subsidiaries of foreign-owned firms accounted for nearly one-fifth of all U.S. goods exports in 2011. In the same year, they employed approximately 5.6 million U.S. workers, with an average salary of \$77,000 per year.

SelectUSA operates as a complement to state and local economic development efforts to promote the United States as the best market for business investment in the world and addresses business climate concerns that may impede investment. SelectUSA accomplishes its mission by responding to investor inquiries, serving as ombudsman for domestic and international investors with concerns and issues involving Federal agencies, connecting investors with U.S. states and cities on a geographically-neutral basis, and undertaking outreach and engagement with the international investor community.

SelectUSA raises awareness about the U.S. business climate, highlights Federal programs and services available to the investment community, and helps counter misinformation about U.S. policy on openness to investment. By working with current and potential investors, U.S. economic development organizations (EDOs), service providers, foreign governments, and multiplier organizations, SelectUSA contributes to overall awareness about opportunities in the United States.

There is significant demand among U.S. state, local, and regional EDOs, as well as among investors, for SelectUSA services. For example, the SelectUSA 2013 Investment Summit attracted 1,300 attendees, with many more on the waiting list. Official representatives of forty-eight states, four territories and the District of Columbia joined investors from all over the world.

SelectUSA is therefore in the process of building out the program to meet the demonstrated demand, address misperceptions about the U.S. market, and effectively compete against nations that spend tens of millions of dollars more on their investment promotion agencies. More

specifically, the funding will enable us to add staff critical to making meaningful progress on the following commitments:

1. We are working to make investment attraction a core priority across key agencies, with coordinated, global teams actively working to facilitate investment and create jobs in the United States. Working closely with the U.S. Department of State, the U.S. Department of Commerce through SelectUSA aims to provide domestic and global teams with the training, resources, and access necessary to fully incorporate investment promotion and facilitation as a core element of U.S. economic and commercial efforts. This includes the development and implementation of aggressive investment promotion plans in SelectUSA's 32 international focus markets. We will also increase efforts to raise awareness of reshoring opportunities among U.S. businesses and provide enhanced counseling assistance to U.S. EDOs, in close coordination with the Economic Development Administration.

2. SelectUSA will strengthen its role as a single point of contact for ready investors looking to create jobs and establish production in the United States. As part of this ongoing effort, SelectUSA has implemented a formalized ombudsman service in partnership with the Interagency Investment Working Group for business investment, including clear channels for case referrals; case management processes; and criteria for successful case resolutions. SelectUSA is expanding efforts to reach and provide timely, high-quality services to investors globally, but current capacity is insufficient. As requests for service from investors continues to increase, SelectUSA's capacity to manage the additional caseload will be further strained during this period of program expansion.

3. SelectUSA has established a coordinated investment advocacy process that includes senior Administration officials, all the way up to the President. This process has been formalized through the Interagency Investment Working Group across more than 20 Federal agencies. As state and local governments learn how this service can assist them to compete with foreign national governments, we are seeing increased interest.

4. SelectUSA is working to increase and provide better-coordinated support for states and localities to attract investment from international investors and from U.S. companies through reshoring. SelectUSA will assist state, regional, and local EDOs to attract investment by improving coordination and strengthening services to meet increased demand.

5. Global Markets and SelectUSA are working to enhance its client management system and its ability to improve how it tracks client services. These improved systems and business processes will enable Global Markets and SelectUSA to better monitor and assess the effectiveness of investments, specifically those for which SelectUSA has a facilitative role. As part of the Department of Commerce's strategic plan, SelectUSA is working to build better capabilities to track the investment clients it assists and any investments that result from that assistance. The additional funding requested by the President for FY 2015 will enable SelectUSA to further develop its program evaluation and analysis capabilities.

4. Knowing there is an investment within the Small Business Administration's request to support BusinessUSA. The sustainability of this program is obtaining the right data and tracking

who is seeking assistance, where they are coming from, and how the assistance they are seeking is helping them expand and create new jobs.

Question: How can BusinessUSA close the information gap and how we can make sure these resources will be a good investment?

Answer: The BusinessUSA initiative is a shared investment that provides businesses, exporters and entrepreneurs with a single access point, BusinessUSA.gov, to find up-to-date information, programs, tools and services that address their business needs. BusinessUSA is co-managed by the U.S. Department of Commerce and the U.S. Small Business Administration. Obtaining information about customer needs, types of customers, and outcomes will be critically important to the success of the initiative. BusinessUSA implements the President's directive to promote the scenario where "...business's interactions with the Federal Government should be individualized and efficient." The only way that this vision can be realized is through leveraging performance data and information.

BusinessUSA has established a robust performance analysis rubric that captures information about site traffic such as:

- the number of visitors,
- types of customers,
- geographic location,
- preferred channels of communication with the Federal Government,
- satisfaction with the service,
- topics/information researched and resources provided by the service,
- whether the customer was able to find their information objective,
- and other relevant factors.

BusinessUSA continually works to enrich its understanding of the customers using the service so that future enhancements can be personalized and designed with the customer in mind. In this regard, BusinessUSA expects to offer services that will allow businesses and entrepreneurs to address their specific business needs. Businesses will voluntarily share information that can be used to more easily direct them to the right government resource. At the same time, BusinessUSA is establishing mechanisms to more efficiently refer customers to Federal and other service providers that deal with incoming business inquiries more efficiently, and better track the outcomes of those referrals. Such data will be instrumental in closing the information gap and maximizing the return on investment in BusinessUSA.

National Export Initiative

Question: Please keep us updated on our progress with respect to the National Export Initiative. Are we on-track to achieve the President's goal of doubling exports by 2014?

Answer: A: The National Export Initiative has been catalytic. Thousands of companies across the country made exporting a strategy to growing their business and many communities have incorporated exporting into their economic development planning.

Dozens of states and communities turned to exports as a path for economic growth to support additional jobs.

American businesses achieved record exports for four consecutive years, with exports supporting a record 11.3 million jobs in 2013. Starting from a base of \$1.8 trillion of exports in 2009, the United States has reached an all-time high of \$2.3 trillion in 2013.

Building on progress of the National Export Initiative, Secretary Pritzker announced NEI/NEXT in mid-May to improve Federal information resources that will help American businesses capitalize on existing and new opportunities to sell Made-in-America goods and services abroad.

The five objectives of NEI/NEXT are rooted in the lessons we have learned from listening to our customers and evaluating our export promotion services, and include:

1. Connecting more U.S. businesses to their next global customer with tailored industry-specific information and assistance.
2. Making the next international shipment easier and less expensive, through efforts to streamline U.S. government export-related services, reporting requirements and processes, and speeding American goods to more markets through domestic infrastructure improvements.
3. Expanding access to finance for U.S. businesses' next export transaction, helping more exporters obtain financing to meet international demand, and ensuring more companies know what products and services are available to reduce risk and export to new markets with confidence.
4. Promoting exports and foreign direct investment attraction as the next economic development priority in communities and regions across the country by enhancing partnerships with local and state leaders and by coordinating with SelectUSA.
5. Creating, fostering and ensuring U.S. business' next global opportunity by helping developed and developing economies improve their business environments, by opening new markets, and by establishing conditions and addressing barriers to allow more American exporters to compete and win abroad.

The United States is poised to capitalize on an increasingly favorable global macroeconomic outlook, and through NEI/NEXT we will continue to support economic growth and create opportunities for U.S. businesses and the American workforce to sell Made-in-America goods and services to more countries.

NOAA

In my district in Alameda County, ocean and coastal industries support more than 32,000 jobs and \$2.2 billion in GDP. Our community faces a real threat: sea level rise. If sea level rise continues as projected, the San Francisco Bay area will face significant flooding and inundation that we need to plan for now.

Question: How is NOAA helping communities like mine prepare for a sustainable future on the coast?

Answer: NOAA has a diverse suite of integrated products and services to address the preparedness, response, recovery and resilience of coastal communities and economics. One of NOAA's top priorities for these activities is addressing the immediate and serious threat of sea level rise. NOAA's physical oceanographic observations and forecast capabilities, along with data from external sources, provide the foundational data for predictions and forecasts. NOAA leverages its science expertise, tools and training development capabilities, and ongoing partnerships with coastal managers to translate these data into actionable coastal intelligence that informs resource protection and management decisions.

One of NOAA's most well known partnership programs, Sea Grant, is committed to improving the nation's ability to understand, plan for, and respond to climate variability and change along our shorelines. Since 2009, NOAA Sea Grant has focused on helping communities in the 33 coastal states and territories better understand climate science and how they can adapt to the opportunities and challenges presented by climate variability and change. In 2012, NOAA Sea Grant held its second Coastal Communities Climate Adaptation Initiative grants competition. Based on the success of the initial projects, funded in 2010, the new projects are helping communities meet the climate change challenges and hazards that threaten their economic and social well-being. A listing of these projects, and progress to date, can be found at: http://seagrant.noaa.gov/Portals/0/Documents/what_we_do/climate/documents/NOAA_Sea_Grant_Community_Climate_Adaptation_Initiative.pdf

NOAA has partnerships with many coastal communities and embraces opportunities to improve planning and adaptation to sea level rise. California state and local governments echo NOAA's resilience priority with their own investment in multiple, ongoing projects including the San Francisco Bay and Outer Coast Sentinel Site Cooperative, the Bay Area Ecosystem Climate Change Consortium, and the Adapting to Rising Tides (ART) project, which focuses on the shoreline of Alameda County from Emeryville to Hayward. The ART project, initiated by the San Francisco Bay Conservation and Development Commission (BCDC) with NOAA and other

partners, is a collaborative planning effort aimed at increasing local and regional preparedness and resilience while protecting critical ecosystems, infrastructure, and community services.

Through the ART project, BCDC, NOAA, and other partners leveraged a variety of NOAA/NOS products, services, tools and information to assess and communicate community vulnerability. For example, high-resolution topographic data was combined with Bay water-surface elevations to develop inundation depth grids and sea level rise maps that were critical components of the project. The ART project resulted in a better understanding of the causes and components of sea level rise vulnerability and risk, how to develop adaptation actions to respond to those risks, and ways to effectively build stakeholder capacity to engage in adaptation planning. For more information on the ART project see: <http://www.csc.noaa.gov/digitalcoast/stories/rising-tides>

Ocean acidification (OA) may seem like a distant problem for many Americans, especially for those who do not live on our coasts. However, the impacts of acidification are showing up on American dinner plates across the country. Chefs, restaurants, and seafood distributors are raising the alarm over the impact of acidification on the \$740 million shellfish industry that supplies grocery stores and restaurants with high quality U.S. harvested shellfish. Restaurants alone are the second largest private sector employer in the U.S., and they represent an important segment of the economy in my district – one that will be hit hard if the homegrown shellfish that comes from California's coast and other nearby regions are harmed by acidification, which could reduce shellfish harvests by 25% in the U.S. over the next 50 years. Ocean acidification is impacting the U.S. shellfish industry and consumers, from restaurants to the average American at the grocery store. As a result, NOAA has requested \$15 million in funding for OA research in FY15.

Question: How will the industry and its consumers be left vulnerable if Congress fails to provide NOAA's requested increase for ocean acidification?

Answer: As you suggest, the United States is facing a seafood supply shortage. A newly-formed organization of seafood industry stakeholders, the Coalition for U.S. Seafood Production (CUSP), has been actively engaged in this issue because they keenly feel the stressors on their industry - up and down the seafood supply chain - of dwindling living marine resources, which are only exacerbated by ocean acidification. CUSP membership comprises the entirety of the seafood value chain – aquaculturists, soybean associations, feed producers, equipment manufacturers, seafood processors, and retail and restaurant chains. The seafood industry is left vulnerable without additional information.

Global ocean chemistry is changing at a rate at least ten times faster than at any time over the past 50 million years in response to rising atmospheric carbon dioxide. This ocean acidification (OA) has been associated with changes in a broad range of marine biological processes including shell formation, recruitment, and behavior. Coastal factors such as upwelling, riverine discharge, nutrient loading, and hypoxia can enhance OA at regional and local scales. In 2009, U.S. shellfish represented about half the total seafood revenue estimated at \$3.9 billion. (Fisheries of the United States 2009, September 2010. National Marine Fisheries Service Office of Science and Technology, Maryland. iv pp.) In Washington State alone, the shellfish industry generates \$270 million annually, and directly and indirectly supports 3,200 jobs. Recreational oyster and

clam harvesters contribute more than \$27 million annually to coastal economies. Coral reefs also provide \$30 billion in ecosystem services to local communities. (*Cesar, H.J.S., Burke, L., and Pet-Soede, L. 2003. The Economics of Worldwide Coral Reef Degradation. Cesar Environmental Economics Consulting, Arnhem, and WWF-Netherlands, Zeist, The Netherlands. 23 pp.*)

NOAA's research efforts are already working in this area. Our scientific contributions to oyster hatcheries in Washington and Oregon have helped reverse the financial losses. To more effectively respond to, and mitigate the impacts of OA, we need to improve our understanding of OA and the impacts to valuable coastal marine resources. NOAA also needs to develop tools and adaptive strategies for affected industries and stakeholders. The following bullets give details on the science, tools, outreach and coordination that will be made possible through the requested increase of funding:

- NOAA will increase monitoring of OA in our coastal waters. This monitoring is expensive; however, it is because of the abundance of marine life in coastal ecosystems that makes monitoring OA there especially important, albeit complicated. Most living marine resources, especially shellfish, live in the coastal zone. Thus, characterizing the environment that living marine resources are now exposed to and modeling the progression of OA in coastal ecosystems are critical components of understanding how the shellfish industry might respond to OA. As of part of the FY 2015 President's Budget, NOAA's Ocean Acidification Program (OAP) will be able to deploy and maintain more assets to monitor OA in coastal environments and will have the capacity to develop complex models for forecasting.
- NOAA will increase observing technologies to enable impacted industries such as the shellfish industry, to be able to monitor the chemistry at their individual locations in order to adapt their practices. Funding included in the FY 2015 President's Budget will fund several of these new technologies. Technologies such as these have already saved an industry on the brink of collapse but more and better systems are needed.
- NOAA will increase investments in state-of-the-art OA facilities to study the impacts of OA on marine species, including more research on how OA affects shellfish production. NOAA's OAP will make funding academic and industry scientist partners a priority. Characterizing the response of shellfish to OA, and the response of their prey and predators, is necessary for understanding and predicting the impacts of OA on the shellfish industry. The OAP aims to provide actionable information, based on sound science, so that industries and managers may adapt.
- NOAA will develop models of how the impacts of OA will ripple through coastal communities. Such socio-economic and human systems research is very limited to date, and additional funding is needed to support these cutting-edge, policy-relevant studies. The FY 2015 budget request supports the development of forecasting models to assist communities in responding to the changing conditions.
- NOAA will conduct research to better understand the risk of ocean acidification beyond the shellfish industry. Impacts to coral reef ecosystems, in tandem with other stresses, could compromise food security for 1 billion people globally, especially those living in small island

developing states. Impacts to food webs will also affect wild catch fisheries in ways not well understood at this time. For instance, early results indicate that the economically important king crab fisheries off Alaska are vulnerable. This increased funding in the FY 2015 budget will help to support this important research.

The Honorable Representative Jose E. Serrano
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on Department of Commerce FY 2015 President's Budget Request

NOAA TSUNAMI WARNING CENTER IN THE CARRIBBEAN

As you know, I have been a long-time supporter of establishing a tsunami forecasting and warning center for the Caribbean. Both history and ongoing research confirm that tsunamis pose a great risk to U.S. jurisdictions in the Caribbean. Historically 96 tsunamis have caused an impact in the Caribbean and resulted in at least 4,562 deaths. Two of the four earthquakes to have hit Puerto Rico in 1867 and 1918 generated dangerous tsunamis which killed a total of 172 people. However since then the number of people and the concentration of infrastructure have grown along these coastlines. The Pacific Tsunami Warning Center (PTWC) is located in Ewa Beach, Hawaii, and is responsible for warning Hawaii, Guam, the Commonwealth of the Northern Mariana Islands and American Samoa, and over 90 foreign countries. The West Coast and Alaska Tsunami Warning Center (ATWC) is located in Palmer, Alaska and is responsible for warning Alaska, coastal states of the U.S. mainland and Canada, as well as Puerto Rico and the U.S. Virgin Islands. I believe that there is a critical need for a tsunami forecasting and warning center in the Caribbean. Last year, Congressman Pierluisi, in conjunction with Congresswoman Christensen and myself, introduced legislation, H.R. 1110, the Tsunami Forecasting and Warning Improvement Act of 2013, which would direct the National Oceanic and Atmospheric Administration (NOAA) to establish and operate an additional tsunami warning center to be located in the Caribbean region.

Question: What is the agency's position on the establishment of a new tsunami warning center to serve the Caribbean and the East Coast?

Answer: At the present time, we believe that Puerto Rico, the Caribbean and the U.S. East Coast are effectively served by the existing tsunami warning centers. The Pacific Tsunami Warning Center (PTWC) delivers real-time tsunami information to the international community in the Caribbean (areas outside Puerto Rico, and the U.S. Virgin Islands) and the National Tsunami Warning Center (NTWC) in Palmer, Alaska, is responsible for issuing specific alerts for Puerto Rico and the U.S. Virgin Islands. Significant advances in tsunami awareness and detection in the Caribbean have been made. Tsunami outreach and education activities have been and will continue to be conducted, and national protocols and standard operational procedures have been developed by many Caribbean nations. As part of these efforts, local and international educational and awareness materials have been prepared, enhanced, adapted, and distributed to partners. In addition, earthquake monitoring in the Caribbean has improved dramatically with 112 new seismic stations and 52 new sea-level sensors integrated into the Caribbean Tsunami Warning System since 2004. Advances in existing communications infrastructure, combined with the increased sensing density, including both seismic and water level networks, have served to mitigate the need for a traditional Tsunami Warning Center to be built in the Caribbean region.

NOAA has also established a Caribbean Tsunami Warning Program at the University of Puerto Rico - Mayaguez dedicated to outreach and education efforts. Local inundation mapping, an activity currently supported by NOAA, of the coastlines is also beneficial in modeling tsunami behavior to help define potential threats. The U.S. Geological Survey also recently upgraded its seismic network in the region, and information from this network is available across the global network, including our Tsunami Warning Centers, in real-time.

Question: How would the department finance the establishment of said center and how would you prioritize a new center with your current capabilities?

Answer: As mentioned above, at the present time, we believe that Puerto Rico, the Caribbean and the U.S. East Coast are effectively served by the existing tsunami warning centers. NOAA constantly evaluates its warning services and capacity to combine NOAA assets with other regional assets to ensure tsunami forecast, warning, and mitigation capabilities meet service needs throughout the Caribbean Region. NOAA remains committed to providing tsunami warning services throughout the Region in the most efficient and effective manner.

Question: Do you believe that the current Alaska and Hawaii Tsunami Warning Centers are sufficient to deal with subsea seismic activities in the Caribbean?

Answer: Yes, we believe the current Tsunami Warning Centers (TWCs), combined with our physical staff presence and programs in Puerto Rico, effectively deal with the tsunami threat in the Caribbean. The average time to issue a tsunami message to emergency management officials in Puerto Rico and the U.S. Virgin Islands is approximately 3 minutes, which is the fastest average response time in any region covered by NOAA's TWCs with the exception of coastal California. This is because response time is dependent on the density of seismic observations, and is not correlated with the location of the servicing TWC. The Puerto Rico/USVI area has one of the densest seismic observing networks in the world.

Question: Can you work with me to find the necessary resources in Commerce's budget to move this forward?

Answer: At the present time, we believe that Puerto Rico, the Caribbean and the U.S. East Coast are effectively served by the existing tsunami warning centers. NOAA is fully committed to providing the same level of tsunami service to the Caribbean as other U.S. coastal areas and to furthering awareness and planning efforts. NOAA is confident that NOAA's existing Tsunami Warning Centers effectively warn the Caribbean in the case of tsunami-generating seismic activity.

NOAA'S REGIONAL OCEAN PARTNERSHIP PROGRAM

The Regional Ocean Partnership (ROP) grant program, funded through NOAA's National Ocean Service, has played an important role in supporting regional partnerships to help coordinate, and plan for, regional priorities in ocean and coastal management. However, despite a request for \$5 million and the support of 46 members of the House of Representatives, NOAA's Regional Ocean Partnership grant program was not funded in the Fiscal Year 2014 omnibus. To make matters worse, NOAA has not requested funding for Regional Ocean Partnership grants in fiscal year 2015. Superstorm Sandy taught us that investments in resilience and coordination in the face of future storms are vital for the protection and recovery of our communities.

Question: Considering the importance of the ROP program to smart ocean planning in and around the country, how does NOAA plan to support and foster these regional ocean partnerships absent any ROP grant funding in the budget?

Answer: Prior to its termination by Congress in FY 2014, the Regional Ocean Partnership Grants program supported development of ROP organizations, governance and implementation plans. Despite the loss of dedicated funding, NOAA remains committed to Regional Ocean Partnerships, as well as other key regional efforts and groups around the country working on ocean and coastal health. NOAA is working with current recipients to make the most use out of funds that have been previously awarded under the ROP program, which have helped support ROP operations in FY2014. NOAA will continue to work with and support these groups, as we have from their inception, through leadership and staff engagement.

While there will be no new funding specifically for ROP operations, current partners will be eligible to apply for the new Regional Coastal Resilience Grants proposed in the administration's FY15 Request to address their respective resilience-related priorities and implement actions within existing plans. *(Clerks note: no funds were requested in the FY15 budget request for Regional Ocean Partnership grants.)*

TUESDAY, APRIL 8, 2014.

NASA REQUEST AND OVERSIGHT OF NASA SECURITY

WITNESSES

**RICHARD THORNBURGH, PANEL CHAIR, NATIONAL ACADEMY OF PUBLIC ADMINISTRATION,
HON. CHARLES F. BOLDEN, JR., ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**

CHAIRMAN'S OPENING REMARKS

Mr. WOLF. Good morning. The hearing will come to order.

We welcome everyone to today's hearing on the National Aeronautics and Space Administration. Our witnesses are Governor Richard Thornburgh, a former Governor of the great State of—Commonwealth of Pennsylvania and Attorney General, and NASA Administrator Charles Bolden.

Thank you both for being here.

The first panel today will focus on issues in NASA's security controls that were brought to light through the work of the National Academy of Public Administration.

Governor Thornburgh, a NAPA fellow, led a team of experts in a comprehensive review of NASA's security practices, culminating in a report that was issued about 2 months ago.

The review was initiated after this subcommittee drew attention to allegations of serious security problems at NASA's Ames and Langley Research Centers.

I hope anyone who questioned the accuracy or the motivation of the allegations is listening today because the review conducted by NAPA, along with separate reviews of the Ames and Langley incidents by the NASA Inspector General, validate that serious problems do exist at NASA and require substantial corrective actions.

To my great frustration and concern, the full contents of those reports are restricted and the publicly available executive summaries are lacking in many of the details and examples that are needed to fully understand the scope of the problem.

Nevertheless, I can say that all three reports drive home the need for NASA to revise, tighten, and standardize its security policies, put in place review mechanisms to better identify instances of noncompliance and more effectively communicate with its employees about security threats, countermeasures, and requirements.

The most upsetting findings in the reports are serious deficiencies in NASA's culture of accountability. Violations of security protocols can and do go effectively unpunished, a fact which provides employees with little or no incentive to make security compliance a personal and a professional priority.

These circumstances need to change. Security compliance is not a trivial concern. And while much of NASA's work is intended to

be widely shared, the agency is still responsible for the development and protection of technologies and information that could easily be used against us by those who seek to damage this country's security or economy. The subcommittee expects that NASA will do better, and I know Administrator Bolden does as well.

The framework for the necessary changes has been established through the work of Governor Thornburgh and the rest of the NAPA team, which made 27 recommendations for improvements to NASA's practices.

I understand that NASA is working now to finalize its plans to implement those recommendations and I appreciate that effort, but the Agency should know that the subcommittee will be following up to ensure that real and lasting institutional changes are made. It would seem to me it would be appropriate for NAPA to come back a year from now and see what progress has been made.

This hearing today is the first step. By establishing a public record on both the nature of the problems and the corrective actions needed to respond to them, it will be harder for NASA leadership, current or future, to walk away from the difficult task of seeing the necessary reforms through to completion.

The topic of security reforms will carry into the start of our second panel with Administrator Bolden, who will have an opportunity to respond to the findings in the NAPA report and outline the Agency's proposed responses to NAPA's recommendations.

In addition, the second panel will take on the task of discussing NASA's 2015 budget request and the agency's programmatic plans for fiscal year 2015.

NASA's request of \$17.46 billion represents a 1 percent decrease from the fiscal year 2014 enacted levels, despite the relatively constant government-wide top line.

The impact of the proposed decreases, which would primarily affect perennial targets like the Space Launch System and Planetary Science, is actually much larger than the agency total would suggest, as the full scale of the proposed cuts are obscured by several substantial requested increases, including new funding for the commercial crew program and Space Station crew and cargo transportation.

We are anxious to discuss NASA's justification for these changes and their expected effects on the agency's ability to achieve its strategic goals.

We also want to consider more generally the efficiency and effectiveness of NASA's operations and its stewardship of Federal funds.

I am sorry to say that a series of recent reports has been really questionable, casting doubt on NASA's decisionmaking in areas as diverse as potential abuse of premium air travel, to lack of control over mobile IT devices, to possible favoritism in awarding of leases.

If NASA is going to continue to receive the support of the Congress, it absolutely must do a better job of demonstrating commitment to fiscal responsibility and compliance with oversight requirements.

In a moment, we will begin our first security focused panel with some brief opening remarks from Governor Thornburgh, who will then answer questions from the subcommittee.

Then we will turn to Administrator Bolden, who will provide his own opening remarks about the security report and the budget request and then proceed to questions on these topics.

Before we get started, I want to recognize the ranking member, Mr. Fattah, for any opening remarks that he would like.

Mr. Fattah.

RANKING MEMBER'S OPENING REMARKS

Mr. FATTAH. Thank you, Mr. Chairman.

And let me welcome our witnesses and, in particular, my Governor to the hearing.

I started in the State legislature—elected in 1982 and was sworn in in January of 1983, some 32 years ago, and Governor Thornburgh was running the shop.

We worked together on a number of important initiatives that the Governor would be happy to know are still doing extraordinary work on behalf of people of Pennsylvania, the Ben Franklin Partnership, which I legislatively sponsored, but the Governor helped provide the resources and the political leadership to get it signed into law, has centers all over the State bringing technical-based enterprises into the State that employ Pennsylvanians and, also, sponsors customized job training efforts at our community colleges.

And we were just together technologically, speaking for the Pro Bono Awards for the Legal Services Corporation, which had its event in Pittsburgh maybe 4 months or so ago. And the Governor spoke by technological means and so did I. Neither one of us were able to be there, but we did want to indicate our support for the work of the Legal Services Corporation.

So I welcome you and I look forward to your testimony.

And I want to note in my opening comments that the Governor is going to say what I think we all agree on as Americans, that NASA is one of the most accomplished agencies in the United States Federal Government and one of the most respected agencies in the world.

But most importantly as he points out in his written testimony, NASA and its leadership at every level cooperated fully with this analysis and review even those charged with top secret activities and as we have seen with a lot of Federal agencies, there are challenges with security. I reference now the Snowden matter and other matters that have been challenging to our government over time.

But this is an important contribution. I want to thank you for doing this work, and we look forward to your comments.

And I also want to acknowledge the presence of the Administrator from NASA and his top leadership team, and we will be hearing from them shortly.

So thank you, Chairman, and I look forward to the testimony and the comments back and forth.

Thank you.

Mr. WOLF. Thank you, Mr. Fattah.

Governor, you can proceed.

GOVERNOR THORNBURGH OPENING STATEMENT

Mr. THORNBURGH. Mr. Chairman, Ranking Member Fattah, and members of the committee, thank you for the opportunity to present the National Academy of Public Administration's assessment of NASA's Foreign National Access Management process.

It is an honor to appear before this committee and to present the National Academy panel's findings and particularly to have the opportunity to provide this information to you, Mr. Chairman, in this your final year in the Congress that you have served so well.

I have had the privilege to work with you on a number of important Academy studies, the FBI that helped improve the Nation's vital law enforcement efforts, an effort where your leadership and wise counsel was terribly important and will be greatly missed in years to come. So hats off to you, Mr. Chairman.

So what is the challenge here? It is implicit in NASA's charter, which directs the agency to work cooperatively and share information with other nations while simultaneously safeguarding its classified and proprietary information and assets. This, as you can imagine, can prove to be a challenging task.

Over the past year, security incidents involving foreign nationals at NASA research centers have led to justifiable scrutiny by the NASA administrator, the media, and most particularly by this committee. Based on a suggestion from the committee, NASA contracted with the Academy to review its Foreign National Access Management effort.

This Academy panel, which I chaired, found that NASA was not doing a thorough and consistent job managing foreign nationals that visit or work at NASA centers or access NASA information technology.

Some NASA centers visited during our review were found to have had very good programs in place while others struggled to meet their foreign national access responsibilities.

This has resulted in inconsistent, ineffective, and often fundamentally flawed outcomes, some of which the committee has already explored. The reason for these unwelcome outcomes are relatively straightforward, and I will highlight two of them.

First, the panel found that, while NASA is among the best organizations in the world, when it comes to managing complex technological efforts, the Agency does not apply its normal degree of program management rigor to Foreign National Access Management, a largely administrative process, FNAM, as I am going to refer to it.

I wish they would come up with a good acronym for that. "FNAM" doesn't make much sense.

But the Foreign National Access Management program is not managed as a program but, rather, in a more stovepiped organizational fashion.

Individual headquarters elements produce overly broad program directives, which, in turn, are subject to widely varying interpretations by NASA centers.

Additionally, NASA headquarters has inadequate means for determining the overall efficacy of their directives and mandated processes so that problem areas can go unrecognized.

Second, during this review, NASA IT professionals expressed strong concerns about the security of the Agency's nonclassified systems, with some believing that these systems have already been compromised.

This finding is reinforced by other reviews of NASA's information technology, including those done by the NASA inspector general.

The fundamentally flawed outcomes that I mentioned earlier result when you couple this loosely structured program with relatively easily penetrable information technology security systems.

I would be remiss if I didn't also note that, while the Academy's focus was on the threat posed by foreign nationals, many of the panel's findings apply equally to threats arising from trusted insiders as well as other parties looking to compromise NASA's information technology.

Before I summarize the panel's findings, I would like to note that NASA provided complete cooperation for this review and that NASA interviewees were candid, cooperative, and eager to both offer their insights and be involved in problem solving.

Most NASA employees understood the challenge to share with as well as to protect information from foreign nationals. NASA senior leaders, including Administrator Bolden, were actively involved in and supportive of the Academy's review.

The panel report describes a number of important steps the Agency can take to improve Foreign National Access Management and has proposed 27 specific recommendations, which I will summarize under six topic areas.

The first topic area is for NASA to manage Foreign National Access Management as a program, that is, eliminate the stovepiped approach and provide some specific guidance.

Second, NASA needs to reduce the flexibility given to centers to interpret Foreign National Access Management requirements, primarily by writing a comprehensive and detailed operating manual covering all functional aspects of the program.

Third, the agency should determine its critical assets and build mechanisms to protect them. This would begin with NASA compiling a comprehensive assessment of threats to its assets and establishing a board to manage the overall effort.

Fourth, NASA needs to correct long-standing information technology security issues, including establishing clear, specific, and mandatory requirements for all centers to follow regarding remote access of their information technology systems and giving the NASA chief information officer more control over IT operations in field centers.

Fifth, change several aspects of NASA's culture. This includes reducing unnecessary competition between NASA field centers, ensuring individuals are held accountable, particularly when serious mistakes are made or important mandates are ignored, and to guard against the organizational tendency to revert back to prior lax habits once a problem has been deemed to have been solved and the tension of the moment has passed.

The sixth and final area involves communicating importance of these changes clearly, firmly, and consistently. The importance of security, the existence of real world threats to NASA assets, and

the need for improvements in handling foreign national issues have not been clearly and consistently communicated throughout NASA.

Senior leaders must firmly establish and communicate their total commitment to an effective Foreign National Access Management program that enhances cooperation while safeguarding information.

In closing, Mr. Chairman, let me note that the Academy was pleased and honored to have the occasion to work with NASA and the committee on this review and to present our testimony today.

I believe that we have provided NASA with a good template for building a more robust and effective Foreign National Access Management program and that the agency has the right leadership with Administrator Bolden and Associate Administrator Robert Lightfoot as well as the commitment to make that happen.

I recently reviewed NASA's response to our review and was pleased to note the consistent endorsement of the panel's findings and recommendations.

By implementing the review recommendations, the panel believes that NASA will not only make mission and security improvements to existing foreign national access systems, but can also realize long-term potential savings by managing its foreign national efforts in a more efficient and effective manner.

Having a well run Foreign National Access Management program is in the best interests of NASA both in terms of protecting vital U.S. security and proprietary information, as well as capitalizing on the talents of foreign nationals. With the committee's support and oversight, I am certain that the Agency will build just such a program.

With me today is Joe Thompson of the NASA staff, who put in long hours and important effort in bringing this report to fruition, and I have asked him to join me at the table here so that he can flesh out some of the answers that I give in a more comprehensive way.

Thank you, Mr. Chairman, for providing us with this opportunity to share these findings with you.

Mr. WOLF. Thank you, Governor.

[The information follows:]

WRITTEN STATEMENT**By****DICK THORNBURGH, PANEL CHAIR****NATIONAL ACADEMY OF PUBLIC ADMINISTRATION****BEFORE THE****HOUSE COMMITTEE ON APPROPRIATIONS****SUBCOMMITTEE ON COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES****TUESDAY, APRIL 8, 2014**

Good morning Mr. Chairman and members of the Committee. Thank you for providing me with the opportunity to present the National Academy of Public Administration's assessment of NASA's Foreign National Access Management practices. As a Congressionally-chartered non-partisan and non-profit organization with nearly 800 distinguished Fellows, the Academy brings seasoned experts together to help public organizations address their most critical challenges. The Academy is proud to have been chosen by NASA to review how it meets those challenges. Not only has the Academy conducted a number of important studies for NASA in the recent past, but both organizations share a common lineage in the person of James Webb, the second NASA Administrator and founder of the Academy in 1967.

NASA's charter directs the agency to work cooperatively and share information with other nations while simultaneously safeguarding its classified and proprietary information and assets. This can prove to be a challenging task. On the one hand, the threat of cyber-attacks and espionage aimed at government agencies by hostile nation-states and foreign adversaries is growing. On the other hand, collaboration and cooperation between nations are hallmarks of modern scientific endeavors.

Over the last year, security incidents involving foreign nationals at NASA research centers have led to justifiable scrutiny by the NASA Administrator, the media and most particularly, this Committee. Recognizing these security challenges, NASA contracted with the Academy to conduct a review of its foreign national operations. How well NASA is able to balance their sometimes conflicting research demands, and what it might do to improve its processes for working with foreign nationals, were at the heart of this review.

NASA is one of the most accomplished agencies in the U.S. federal government and one of the most respected government entities in the world. To accomplish its mission, NASA works collaboratively with many nations on a broad range of scientific and engineering projects. Foreign national participation in NASA programs and projects is an inherent and essential

element in NASA operations. No better illustration of this partnership is the fact that during 2013, NASA's international operations were being supported by over 600 cooperative agreements with 120 nations.

Having a well-run Foreign National Access Management program is in the best interests of NASA, both in terms of protecting vital U.S. security and proprietary information, as well as capitalizing on the talents of foreign nationals. This Academy review examined the Agency's entire Foreign National Access Management process from the initial request from a requestor or sponsor through foreign national vetting, credentialing, information technology security, counterintelligence, hosting and escort procedures, and export controls.

Before I present the Panel's findings I would like to note that NASA provided complete cooperation for this review and that NASA interviewees were candid, cooperative, and eager to both offer suggestions and be involved in problem solving. Most NASA employees understood the challenge to share with, as well as to protect information from foreign nationals. During this review, Academy staff interviewed over 150 individuals during visits to 5 NASA Centers, NASA Headquarters and several other Federal agencies. They also reviewed all relevant FNAM directives, reports and studies.

The Panel is sensitive to current Federal budget challenges and has worked to keep its recommendations within achievable budget limits although some may prove to be resource-intensive. The Panel believes that NASA can not only make mission and security improvements to existing foreign national access systems by following its recommendations but can also realize long-term potential savings by managing its foreign national efforts in a more efficient and effective manner. This testimony will represent the major findings of the Academy Panel's review that generally follow the overarching areas NASA asked the Academy to review.

Organizational and Functional Relationships

There is no systematic approach to FNAM at NASA; rather, there are individual (HQ) program requirements coupled with individual Center approaches. Simply put, there is no overall FNAM program, just separate FNAM processes – credentialing, export control, counterintelligence, IT access, etc. – that are viewed as a series of related tasks performed by independent organizations and individuals, and which often result in less than optimal outcomes.

When FNAM is viewed through these individual lenses, the judgments made about its efficacy are often subjective and incomplete. Evaluations focus on the various components without consideration given to the overall effect of these processes. When coupled with the lack of good program audit mechanisms, the chances for things going wrong rise significantly. This is particularly ironic, given that NASA is one of the most successful organizations in the world at

practicing high-quality program management. The Panel has no doubt that any effort by the Agency to take a Program Management approach to FNAM would be successful.

FNAM Directives

An integral part of this review involved assessing the efficiency and effectiveness of the guidance provided by specific NASA publications pertaining to Foreign National Access Management (FNAM). In general, the Academy found that NASA Procedural Requirements (NPRs) and NASA Policy Directives (NPDs) were comprehensive, well-written, and easily accessible through NASA's online library. These documents provided answers to the "who, what, why, where, and when" questions, but did not adequately provide effective and practical guidance on "how" responsible individuals, officials, and entities were to perform their designated tasks. This was determined to be particularly true with processes that involved multiple individuals and organizations.

Through the interviews conducted at the Centers, it was clear that employees and contractors were aware of the existence of the FNAM publications, but those documents were infrequently utilized in the performance of day-to-day tasks and assignments. Most personnel relied on their own experience or that of their peers when faced with an issue or problem. In some cases, Centers have developed and published their own procedural requirements that were found to be more practical and user-friendly.

The Panel notes that uniformity and consistency in organizational performance by other federal agencies is directly correlated with the existence and routine use of agency-wide, clear, and concise direction and guidance. Most often, this guidance is disseminated through the publication of manuals and guidelines that provide simplified and practical instruction on the performance of specific tasks, as required by procedural and policy mandates. This observation was independently validated by NASA interviewees who noted the need for specific guidance on how to best perform certain FNAM functional requirements – that is – vetting, credentialing, sponsoring, escorting, and export control.

NASA states that compliance with each NPR and NPD is mandatory, and accountability for the aspects of each program and function is established. Despite these statements, the Academy found that there is little accountability for non-compliance when identified through specific incidents or periodic assessments. This validates the identified perception among NASA personnel that "mandatory compliance" means little, as there are few, if any, consequences for deliberate or inadvertent violations of the mandates. This combination of overly-broad directives combined with limited accountability has led to both varying processes and undesired outcomes.

NASA Decentralized Management

NASA needs to take steps to reduce the decentralized authority given to Centers for implementing FNAM and other largely procedural or enterprise-wide processes. NASA has a longstanding, highly decentralized organizational structure, with very independent field Centers. Allowing Centers great latitude to implement policies to fit their particular circumstances has the advantage of improving prospects for buy-in and creating policies and procedures which best fit local circumstances, but it can hamper enterprise solutions when such solutions are required. Different interpretations of NASA Procedural Requirements by individual Centers can result in widely varying FNAM performance among Centers.

If too much flexibility in largely procedural processes (which is what much of FNAM consists of) is coupled with a “stovepiped” organizational structure as mentioned above, then results become less predictable and often the opposite of what was intended. The benefits of tailoring and flexibility are outweighed by the inconsistency and often poor outcomes that result from this approach.

Tracking Foreign Nationals at NASA

Individuals requiring access to NASA facilities undergo vetting via an automated system designed to capture and store identity and credential data based on the visit type, residency and country affiliation. A requestor must submit a request for a visit via the **Identity Management and Account Exchange (IdMAX)** system which is an automated workflow tool used to process individuals for access to NASA facilities. IdMAX provides a record for identity confirmation and type of access (visitor, staff, contractor, foreign national), whether IT access is allowed and to what level. It is a single repository for anyone with access to NASA facilities or NASA data. The database asks a series of questions to determine level of access based on confidence and risk factors and is part of a larger program called Identity Credential and Access Management (ICAM).

The review found inconsistent application of and compliance with established policies, as well as broad interpretation of the NPRs regarding IdMAX. Centers have established different processes for the same activities, e.g. processing foreign nationals onto the facility and deciding who is allowed access to the systems.

Information Technology Security

A 2013 NASA IG Audit on Information Technology Governance stated that the NASA CIO has a restricted ability to standardize assets across the Agency to ensure that security policies are adhered to. The OCIO also has very limited capabilities for monitoring the Agency’s mission networks and has to instead rely on self-reporting of vulnerabilities by the mission IT

staffs. These limitations are further compounded by the fact that NASA does not have a complete inventory of IT assets. The Academy's research and findings in these respects are consistent with the IG report.

NASA systems are decentralized and the responsibility for management and security is delegated to the Centers. Center CIOs and system owners have considerable autonomy in managing their systems. System owners determine access controls and have the ability to add networks or connect to external networks. Most Center CIOs have the ability to monitor the "health" of their networks locally, but no authority to require that system owners allow monitoring by the Center or the Security Operations Center (SOC). Most of them noted that they have no ability to prevent mission managers from establishing stand-alone systems or adding back end connections to the network.

NASA has a culture of information sharing and Agency information systems were designed to facilitate such sharing as opposed to identifying, monitoring or preventing potential threats. A 2010 NASA memorandum highlighted the state of NASA systems, and the impacts of unauthorized access to Agency systems, to include *"loss of productivity, theft of intellectual property (data exfiltration), and public embarrassment."* A NASA white paper from that same year outlined the state of NASA's compromised environment, providing details of the threats the Agency faced, the vulnerabilities that were being exploited and detailed examples of recent incidents.

Due to the fact that the NASA systems lack the necessary controls to protect information, allow foreign nationals access to the networks, and allow remote access, the Panel concludes that the NASA networks are compromised. Publicly available reports on systemic data breaches across the country, NASA's own internal reports, and briefings given to Academy staff leave little doubt that information contained on the NASA IT systems is compromised.

Counterintelligence Awareness and Education Programs

NASA directives state that the purpose of the counterintelligence and counterterrorism (CI/CT) program *"is to detect, deter, and neutralize potential threats posed by foreign intelligence services (FIS), other foreign entities, and acts of terrorism to include trusted insiders who would engage in activities on behalf of an FIS or terrorist entity."* When NASA's CI Program was created, no additional personnel were hired. Instead, CI responsibilities were given to Center security personnel as ancillary duties. A 2000 study of NASA's counterintelligence capabilities recommended that the CI personnel be assigned to CI matters on a full-time basis, and be responsible to both Center management and HQ. NASA assigned CISAs to work only CI/CT matters and then centralized the CI/CT program under the Director of the CI/CT Division at HQ.

The Panel found that the current number of personnel assigned to the CI/CT Program is inadequate to formulate, manage, and perform effective CI Awareness and Education programs and that Center-based CI Special Agents (CISAs) would function more effectively if placed under Center management with close HQ oversight. The Panel also found that CI awareness briefings do not seem to be a priority and that CI awareness and education at the Centers and at HQ varies greatly, with some being ineffective.

The CI travel briefing program appears to have the most consistency and clarity of the CI programs, but it reaches only a limited number of personnel. The Academy found that most CI Special Agents appear to be very conscientious in contacting travelers to Designated Countries and high-threat areas, and in providing updated travel briefings. Some Centers send significantly more foreign travelers to Designated and high-threat countries than others, and the Special Agents in these high-travel Centers are especially diligent in their attempts to brief all of their frequent travelers.

Procedures for Hosting and Escorting Foreign Nationals

Hosting of visitors to NASA facilities, including foreign nationals, can encompass all phases of Foreign National Access Management (FNAM) – from initial identification of foreign visitors through termination of their physical or remote access to NASA assets. This can also involve policies, procedures, and processes pertaining to foreign national vetting, badging, escorting, accessing facilities and information technology systems, export control issues, monitoring, awareness and training, as well as the interrelationships of the NASA HQ and Center organizations.

NASA Headquarters (HQ) Officials and Center Directors have not adequately communicated that strict compliance was and is required for foreign national hosting, sponsoring, and escort policy and procedures. There is little uniformity and consistency in the application of the procedural requirements for hosts/sponsors and escorts among the Centers. This includes briefings and debriefings, the documents used to delineate the physical and/or logical access plans, and the duties and responsibilities of those involved in the process.

Foreign National Access Management (FNAM) procedures, particularly for those individuals from Designated Countries and high-threat locations, are considered by requesters, sponsors, and escorts to be too complex, confusing, and time-consuming. This has created a reluctance or refusal to utilize the expertise and skills of foreign nationals by some NASA sponsors. Integrated Functional Reviews and CI/CT Evaluations which NASA conducts do not specifically address the performance of the tasks pertaining to hosting/sponsoring and escorting foreign nationals and the required briefings of sponsors and escorts of foreign nationals have not adequately conveyed the risk that an individual might pose to NASA assets.

Export Control

NASA's export policy directive clearly states that it "*is NASA policy to ensure that exports and transfers of commodities, technical data, or software to foreign persons are carried out in accordance with the United States export control laws and regulations, and Administration and NASA policy.*" The Export Control program needs a more standardized and systematic approach in furtherance of its export compliance objectives, as well as better audit and review mechanisms. NASA senior leaders also need to more strongly endorse the critical importance of such controls. The training provided to Center staff members who need to be aware of export control issues is Center-centric and widely-varied. Some Centers have mandated training for all staff on an annual basis. Others take a more *laissez-faire* approach with training either being optional or, if mandatory, provides no sanctions against those who fail to take the training.

These *laissez-faire* approaches tend to create misunderstandings and even a degree of mistrust and hostility between the various parties. Academy staff heard numerous complaints from researchers about Center Export Administrators (CEAs) and their "unnecessarily bureaucratic" and "time-consuming" reviews and conversely, heard complaints from CEAs about "unreasonable" demands for turning-around documents which always seem to be submitted for review at the last minute. Such complaints indicate a lack of communication about both time frames and rationales for these types of security measures. In summary, the Panel Export control training requirements are inconsistent; the training is confusing and inadequate; and the rationale for such training is often poorly understood.

Monitoring FNAM Compliance and Performance

NASA needs more robust mechanisms for ensuring that FNAM policy requirements are being met by field Centers. There have been recent improvements by NASA HQ in auditing and assessing field Center FNAM efforts but more needs to be done. Absent an improved system of oversight, the Agency will remain uncertain about how well FNAM is being conducted. There are a number of time-tested approaches to this but one which needs to be considered is the use of cross-functional teams to review Center FNAM operations. Such teams could review the individual program compliance metrics (e.g., export control, credentialing, etc.) as well as the overall performance and outcomes of FNAM at the Center. Team membership should include not only HQ program specialists but also FNAM staff from other Centers to both provide a field perspective and to propagate the cross-fertilization of ideas.

As opposed to doing the organizational-specific compliance audits as is the practice today, the teams' reviews should result in comprehensive Center-specific assessments in which all physical, technological and informational assets are identified; actual and potential threats to

those assets evaluated; risks assessed; protective strategies developed; and resource requirements prioritized.

Asset Protection

The task of protecting NASA's assets – its facilities, personnel, technologies, and information – is a multi-dimensional responsibility involving every NASA civil servant, contractor, and organization, as well as the support and assistance of other agencies. The successful performance of this task is dependent on completion of a number of interrelated functions – identification of assets requiring protection, accurate intelligence regarding threats, design and implementation of protective strategies, education and awareness of NASA personnel, and continuous evaluation to ensure threats are countered commensurate with their importance. This requires a comprehensive approach to risk management, employing the best practices available.

During this study, the Academy observed the following regarding NASA's asset protection efforts:

- Centers differ in their efforts to identify assets that require protection, with responsibility placed on several different components.
- Threats have not been adequately conveyed to Center personnel.
- Extensive instructional/training material available through the FBI, Department of Energy (DOE), Office of the National Counterintelligence Executive (NCIX), and other Intelligence Community (IC) agencies has not been utilized to educate NASA staff on the threats posed by insiders, hostile intelligence services, terrorism, and economic espionage.
- Specific intelligence regarding threats posed by foreign nationals and insiders to specific NASA assets is available from IC agencies, but has been inconsistently utilized to educate NASA personnel.
- Detailed policies, procedures, and instructions regarding comprehensive approaches to asset protection have been implemented by other agencies, particularly DOE, and should be reviewed for possible utilization by NASA.
- Independent and Management Assessment and Evaluations, employed by IC agencies, should be regularly utilized to determine the effectiveness of NASA's asset protection efforts, gaps in those procedures, and assurance that proper resources are committed commensurate with the risk.

NASA needs to reconsider how it assesses and protects its information and security assets in the field. While this review has focused on FNAME, the Panel believes that a broader approach to

asset protection and oversight is needed. NASA facilities, personnel, technologies, and information are highly regarded and of great interest to the world. That interest extends to some countries, governments, organizations, and individuals whose intent is to compromise those facilities, co-opt the personnel, and steal those technologies and information. While NASA currently conducts annual threat assessments at every Center by the Protective Services office, counterintelligence special agents, and the CIO, those assessments address only the areas of responsibility of those individual offices. They are not comprehensive, Center-specific assessments that consider all the elements necessary to fully protect NASA's assets.

The Panel believes NASA needs an Asset Protection Oversight Board to oversee the safety and security of NASA assets in the field. The overall goal of the Board is to protect all of NASA's valuable technical data and proprietary information, not simply the data potentially exposed to foreign nationals and to also compile threat assessments from the various elements into comprehensive Center and agency threat/risk assessments. These assessments could be incorporated into NASA's risk management process. By establishing a mechanism for comprehensive, Center-specific assessments NASA could identify and prioritize vulnerable assets, assess protective strategies, allocate resources commensurate with the risk, and evaluate the overall asset protection efforts.

NASA Internal Controls and Risk Management

NASA needs to reconsider how it assesses and protects its information and security assets in the field. The NASA Management System Working Group (MSWG) serves "as the Community of Practice (COP) for NASA internal controls activities and the effective integration of internal controls into any agency-wide Integrated Management System (IMS)." The MSWG scope covers NASA Headquarters, NASA Centers, and their associated facilities. This charter is consistent with the broad scope intended by OMB Circular A-123. Unlike many federal agencies that implement internal controls with an overly strong focus on financial reporting, MSWG is a newly-revised organization under the direction of a new Associate Administrator.

While responsibility for internal controls over financial reporting is placed under the NASA Chief Financial Officer, overall responsibility for NASA-wide internal controls – and providing direction to the MSWG – is placed under the Director, Office of Internal Controls and Management Systems, who in turn reports to the Associate Administrator for Mission Support. This management structure clearly signals NASA's recognition that internal controls apply universally across all areas of the agency, and is not focused exclusively on financial reporting.

While NASA's intent is to establish an internal controls management framework across all organizational elements, the effective implementation of the policy outlined is not consistent. A Senior Assessment Team (SAT) oversees the internal controls program and has as members representatives from all program and functional areas of NASA. However, the SAT is able to

assess, prioritize and correct control deficiencies only to the degree such deficiencies are brought to the SAT's attention. Unfortunately, there are management processes operating at the Center level that identify problems and risks, but that are disconnected from the internal controls process.

NASA's Surveys, Audits and Reviews (SAR) Policy generates insights at the Center-level on various risks and problems. However, the only formal connection between this set of processes and the internal controls program is that Center Directors submit their Certification Statements to HQ to be included in the Agency's annual Assurance Statement. To the degree that the [SAR] program identifies risks associated with internal operations and processes, there should be a communications path to ensure such risks and control deficiencies inform the internal controls program. Moreover, all control deficiencies identified at the Center level are not currently required to be reported to Headquarters. As a result, there is no ability of the SAT to independently assess the degree of completeness of information forwarded to the SAT by the Center. Meaningful transparency would allow the SAT complete access to internal controls findings at the Center level.

The Panel notes that NASA's annual Statement of Assurance (SoA) rolls up/includes risks that are obtained from the Centers and NASA policies make it clear that internal controls are the responsibility of the Center Directors and other appropriate officials who also are required to perform self-assessments and submit Certification Statements. However, the Panel believes that the current process is not sufficient and that an oversight entity is needed by NASA to focus on the following goals and objectives:

- Develop a multi-disciplinary template for use by Center personnel to periodically identify assets to be protected, internal and external threats based on self-assessments and intelligence received, resource and/or technological enhancements needed, and deficiencies identified and/or improvements required.
- Collate the comprehensive Center risk assessments into an agency-wide risk assessment to be provided to executive management for determining resource allocation, budgetary requests, and organizational performance assessments.
- Center and agency risk assessments should be provided to those entities having internal control responsibilities, to include the CFO and MSWG.
- Enhance liaison with Intelligence Community (IC) agencies to disseminate and vet Center and agency risk assessments, obtain current intelligence on targeting of NASA assets by individuals, organizations, or governments, leverage successful protective strategies developed by those agencies, and utilize their training and awareness materials and resources to educate NASA civil servants and contractors.

- Establish an Independent Assessment/Inspection team to periodically assess and evaluate each Center's organizational and functional performance in all facets of asset protection, to include FNAM, physical security, IT security, export control, training and awareness, and liaison. Particular emphasis should be placed on evaluating organizational interactions and relationships, with input from Center management and affected personnel.

The Panel believes that establishing a mechanism for comprehensive, Center-specific assessments and creating an oversight entity to manage this process would allow NASA to fully integrate both its HQ and Center internal controls and risk management efforts into a comprehensive and cohesive effort.

Potential Organizational Changes

There are a several organizational changes NASA can make to strengthen FNAM. The Panel believes that Counterintelligence Staff in the field would function more successfully if they were integrated into the field Protective Services staff under the ultimate supervision of the Center Director. Although plausible arguments can be made to keep the CI staff under HQ management, observations by Academy staff during field Center visits, as well as the CI/CT assessment of 2000, led to the conclusion that the special agents would be more integrated into overall operations, and consequently more successful, if put under Center management. The danger of having them diverted to non-CI tasks as has taken place in the past when they were under Center management, can be mitigated by having clear policies forbidding same and strong audit reviews to make sure it is not happening.

The Panel also thinks the time is appropriate for an elevation of the organization with the primary responsibility for Foreign National Access Management – Protective Services in NASA Headquarters – to be moved onto a level with more direct reporting responsibilities to the Office of the Administrator to ensure that these critical issues receive the appropriate amount of leadership attention. The Panel believes that more visibility for HQ OPS coupled with a stronger relationship with field counterparts will help to strengthen NASA's overall security.

Finally, certain key FNAM-related jobs in the field, specifically the Chiefs of the Office of Protective Services, Center Export Administrators, and Counterintelligence Special Agents should have formal, recognized relationships with their HQ counterparts. Forging a strong linkage (a "dotted-line" organizational relationship) between the HQ and field entities can only strengthen FNAM. Currently, Center OPS Chief selections and evaluations require the endorsement of the HQ Assistant Administrator for OPS. Although there are consultations regarding selections, Academy staff could not find evidence that HQ endorses Center OPS Chiefs' evaluations.

The NASA CIO is currently the supervisor of Center CIOs but there are two observations the Panel makes about this: first, some Center CIOs interviewed by Academy staff were unaware of this reporting responsibility; and, second, the Panel believes mission CIOs should also require the NASA CIO's endorsement prior to their selection and annual evaluation. That currently is not the practice at NASA. The Panel believes that forging a strong link between these line and staff positions while still maintaining a strong field-based approach will help ensure that asset protection is well done and remains a priority.

Competition between Field Centers

Unnecessary competition between Centers is counterproductive. Competition can potentially hamper non-mission activities that often require a more structured, consistent approach, and most particularly, the sharing of best practices. Having Centers struggle to solve problems that other Centers already resolved, which the Academy staff observed during their Center visits, is a waste of time and money and jeopardizes the success of the program. When it comes to FNAM, Center competition does not “improve the breed.” It actually hurts in two ways: Centers with solutions might be disinclined to assist “competitors” and Centers experiencing problems might be concerned about exposing weaknesses in their operations.

An additional consideration is the need for NASA to approach its current budget situation in an organizationally united fashion. Competition between Centers is anathema to this requirement. NASA budget constraints – “flat is the new up” – require a mission approach that drives Centers to work collaboratively with each other and HQ, to ensure that scarce mission-critical resources are not squandered by unnecessary redundancy and waste.

NASA Culture

Any discussion of Foreign National Access Management problems and potential solutions must take into account NASA culture which plays an important role in every aspect of NASA operations. NASA is seen as a desirable place to work with a highly-educated, talented and committed, but rapidly-aging, workforce. In 2013, it was ranked “Best Place to Work in Government” in an annual poll. The Agency has an important, high-profile mission and the NASA “brand” is recognized and admired throughout the world. NASA culture plays an important role in creating these attitudes and perceptions.

NASA research is done largely in a collegial atmosphere with the grounds on each Center being referred to as a “campus.” This fosters the sharing of information, an essential element in research, but can create tension between the need to collaborate and the need to protect classified or otherwise sensitive information. There is also a tendency for some staff to find a “work-around” for procedures and policies they do not agree with or believe to be erroneous, including some FNAM requirements. NASA also often uses an informal (i.e., non-hierarchical) approach

to management of people and processes. Directives, and orders, can be seen more as “guidance” as opposed to mandatory policy and procedural requirements that must be adhered to. This can lead to communications breakdowns and negative outcomes.

NASA leaders shared the concern with Academy staff that after fixing a problem, the Agency has a tendency to lapse back into old habits once the spotlight is off the area under review, in this case, FNAM. A number of NASA leaders also noted that the Agency tends not to hold individuals accountable even when they make serious, preventable errors. Whenever an example of such an error was mentioned during the interviews, Academy staff would follow-up with: *what happened to those responsible for the error?* In almost every instance, the answer was either “nothing” or “I don’t know.” The belief that individuals are not held accountable for ignoring or deliberately failing to comply with FNAM requirements is widespread and includes both managers and rank-and-file employees.

If there are no consequences for ignoring or significantly deviating from a policy requirement or directive, then the chance of the policy or directive being implemented as intended decline dramatically. An important element in changing this attitude and driving compliance is the certainty that processes and outcomes will be reviewed by external entities. This is not to suggest a harsh or unforgiving approach to discipline; the goal is not punishment but reinforcement of behavioral norms.

Panel Recommendations

The Panel made 27 recommendations to NASA as to how it can improve its Foreign National Access Management in its final report which can be summarized into the following six headings:

1. **Manage FNAM as a Program.** The Panel proposed a number of steps for NASA to take which would begin to coordinate efforts and secure better results including realignment of both field and Headquarters organizational elements, strengthening the oversight capabilities of headquarters, and, improving training by developing comprehensive, integrated curriculums and lesson plans.
2. **Reduce the flexibility given to Centers to interpret FNAM requirements.** The Panel recommended that NASA Headquarters write a comprehensive and detailed FNAM operating manual covering all functional aspects of the program. Currently, FNAM directives can be found in several different publications, each with their own Headquarters and field constituencies. Headquarters staff should work in consultation with knowledgeable field staff to create this manual.
3. **Determine critical assets and build mechanisms to protect them.** The Panel envisions the creation of an Asset Protection Oversight Board which would use the results of the Independent Review Teams assessments of individual program compliance metrics as

well as overall performance and outcomes of FNAME and the adequacy of the comprehensive threat/risk assessment at each Center.

4. **Correct longstanding information technology security issues.** The Panel believes NASA needs to identify and protect sensitive, proprietary information in a manner that does not prevent system owners from meeting their mission needs. Among the specific recommendations in this area are for NASA to establish clear, specific, and mandatory requirements for all Centers to follow regarding remote access of their information technology systems and that the NASA Chief Information Officer be given more control over IT operations in field Centers.
5. **Work to change several aspects of NASA culture.** Included in this are the recommendations to reduce unnecessary competition between field centers, ensure that accountability for conforming to FNAME requirements is established, and finally, to guard against the organizational tendency to revert back to prior lax habits once a problem area has been addressed.
6. **Communicate the importance of these FNAME changes clearly, firmly and consistently.** The importance of security, the existence of “real world” threats to NASA assets, and the need for improvements in handling foreign national issues have not been clearly and consistently communicated throughout NASA. Senior leaders must firmly establish and communicate their total commitment to an effective Foreign National Access Management program that enhances cooperation while safeguarding information.

In closing, let me note that the Academy was pleased and honored to work with NASA and the Committee on this review and to present this testimony today. I believe that we have provided NASA with a good template for building a robust and effective Foreign National Access Management program and that the Agency has the right leadership and commitment to make that happen. With the Committee’s support and oversight, I am certain this program will provide NASA with the foreign talent it needs to fulfill its mission while capably safeguarding sensitive information.

Thank you for providing me this opportunity to share these views with you.

SECURITY COMPLIANCE AND PERFORMANCE

Mr. WOLF. The report's public executive summary contains a high-level discussion of your findings, but lacks the details and examples to put these findings into context and drive home their real meaning.

Without being able to discuss those details and examples here, can you instead characterize the seriousness of the problems that you discovered in NASA? Can you confirm that the issues you addressed are not trivial and are, in fact, serious and important?

Mr. THORNBURGH. Without question, Mr. Chairman, these are insidious threats that are posed to the integrity of an operation that is bound by its charter to interact on an almost daily basis with foreign nationals, and I think that the more attention that is paid to the effort to ensure that our security and our technology is not compromised by access of foreign nationals, which is part of its responsibility, I hasten to add, but—that steps be taken to ensure that that cooperation and that program is carried out in a way that is not going to have an adverse effect on our national security.

Mr. WOLF. Based on your personal knowledge or any formal evaluations that were conducted as part of the NAPA team's work, how would you compare the level of security enforcement and compliance at NASA with other Federal agencies?

Mr. THORNBURGH. That is a tough one, Mr. Chairman. I am not sure I am in a position to answer that.

I would hope that—in many respects that NASA is a model for other agencies, but I suspect that, in the particulars that we have identified in our report as being detrimental to the integrity of the program, there are counterparts in other areas of government. But our charter didn't extend to that; so, I can't really give you a responsible answer.

Mr. WOLF. Part of accountability is punishing the guilty. Another part is ensuring that the innocent know that the guilty have been punished, which promotes confidence in the system. It deters future violations looking forward.

Spreading the word about ramifications, however, is complicated by legal requirements to keep private many human resource-related actions, such as demotions, letters of reprimand or a denial of bonuses.

What can NASA do to demonstrate the rigor and legitimacy of the system of accountability while still abiding by these human resources requirements?

Mr. THORNBURGH. I think, Mr. Chairman, what we have pointed out in our review is that there is a broad—within NASA, in significant portions of its operations, a feeling that there is no sanctioning process worthy of the name when it comes to these kinds of lapses.

There are specific responsibilities imposed presently and would be increased under our recommendation that have to be enforced by having a monitoring-auditing process, if you will, that would identify and mete out appropriate sanctions to people who violate their responsibilities under this.

These are not criminal cases. These are not things that you would want to investigate necessarily from that point of view, al-

though I am sure that, as you know, there have already been criminal cases identified out of this.

But I think what we are talking about here is the culture, and the culture has to be one that recognizes that there is a price to be paid for failure to abide by the rules. And our approach was framed along that line.

COST OF IMPLEMENTING NAPA'S RECOMMENDATIONS

Mr. WOLF. On to cost. You mentioned it briefly there, but you can go into more detail.

Can you describe how NAPA took potential costs into consideration when assigning priority levels to your various recommendations?

It appears the answer may very well be "yes" based on your sentence or two, but could the full implementation of some of your recommendations actually result in long-term cost savings to NASA through the elimination of inefficient or duplicative systems?

Mr. THORNBURGH. That is an often-expressed desire on the part of people who are proposing changes in programs, that they will actually reduce costs.

But I think here you have an example of a case where that could be accomplished, and I think that the easiest way to validate that statement is to look at what we have described as the stovepiping approach that is made among several of the centers.

There are also problems that have been solved at the level of the centers that have not been shared or dedicated throughout the Agency.

It doesn't make any sense at all to have two separate components working on a problem that one of them has already solved, and, unfortunately, that crops up from time to time. So, again, it is a management challenge.

And given the esprit de corps that exists within NAPA and its staff, that direction, if made clear by those in authority, I am sure would be followed.

But too often now, because of this fragmented nature of the operation, those—any attempt to impose a uniform structure runs into predictable problems.

But here I think what we have recommended are all things that can be carried out without disruption and, as I have expressed, I hope, could actually result in some savings by cutting down on duplication and the like.

NASA FOLLOWING RECOMMENDATION OF THE NAPA REPORT

Mr. WOLF. One of your report's findings was that NASA has the tendency to revert back to bad habits once a crisis has passed.

What is the best way to ensure that doesn't happen in this case? Are follow-up assessments of NASA's progress a good idea?

I will ask the Administrator, too, but do you think it makes sense for the committee to direct or NASA to commit to have NAPA come back and see if the report's findings have been followed?

Mr. THORNBURGH. Well, obviously, there is a tendency here as elsewhere to—problems are sometimes out of sight, out of mind. If they are identified and not acted upon, the symptoms are going to

persist and you are going to have additional difficulties down the road.

Clearly, in an exercise like this where we have undertaken to identify problems and propose some solutions, an audit function somewhere within the government has to ensure that either those recommendations have been followed and implemented or there is a good reason why they haven't been followed or implemented.

And the chairman will recall, I am sure, the *modus operandi* that we used in connection with the post-9/11 FBI matter where an initial report was undertaken followed by a series of more tailored responses to particular problems.

I happen to think that that is a good way of doing business. I hope I am not falling into the category of being too familiar with what has gone forward.

But I think there is a need either inside or outside of the government structure to absolutely check on whether or not these recommendations have been implemented or, if not, whether there is a good reason why they haven't.

I did not see in the Administrator's response to our review any strong objection to any of the recommendations made and, therefore, would hope that there would be a smooth, cooperative effort to see that they are implemented.

Mr. WOLF. The FBI thing went on for how many years?

Mr. THORNBURGH. Seven years.

Mr. WOLF. Yeah.

So this is not as difficult as that, but I think that the committee should carry language and we will ask the Administrator about it, too.

But I think—

Mr. THORNBURGH. Seven years you won't be here.

Mr. WOLF. No. I won't.

Mr. THORNBURGH. And I probably won't be here either.

Mr. WOLF. Well, now, don't say that. You know, I think you will be here. Maybe we will continue—

Mr. THORNBURGH. I don't mean in the physical sense. But I don't think this will go on for 7 years.

Mr. WOLF. Okay. I wanted to cover that for you, and I wanted to call your wife to tell her that, too.

But, I think we do have to look at it one more time.

Mr. THORNBURGH. I thought the FBI thing worked pretty well.

Mr. WOLF. It worked very well.

Mr. THORNBURGH. And we had—as we have had from Administrator Bolden, we had from Director Mueller full and total cooperation.

And some day that story will be told and it will be worth telling because it is a little bit like trying to turn around the QUEEN MARY when you are dealing with the FBI.

It really took a concerted effort on the part of people in and out of government to create what I think today and preserve what is today as the world's best, finest law enforcement agency.

INFORMATION TECHNOLOGY SECURITY

Mr. WOLF. Right. I think that is something that worked very well. I also think you made a tremendous difference, having been the Attorney General of the United States.

I don't think the FBI quite felt so threatened, as they would have if we brought in somebody who didn't quite understand them.

Secondly, I think it is a tribute to former Director Mueller that he was very open.

Last two questions, and then I am going to go on to Mr. Fattah.

Your panel's intention was to focus on foreign national access to Facilities, systems and information, but your report makes a number of findings and recommendations on IT security that are broader than just foreign national access.

Why did you feel the need to widen the scope of your review in this area? And were you surprised by the scope of IT security issues you discovered at NASA?

Mr. THORNBURGH. I think it is a frequent experience that, when you start pulling at a loose thread, pretty soon you have the whole cloth in your hand.

And here I think a number of the issues that we looked at in detail predictably leached over into other aspects of NASA's operations, and we felt that, although it wasn't specifically within our charter to—felt obliged to take note of that and bring it to the attention of the Agency so that they could act on it.

I think—look, I have got to admit, Mr. Chairman, I am a big fan of NASA and a big fan of the FBI, and working on programs from you such as this is in no way meant to disparage the efforts that have been done previously or being carried out now to effect the kind of changes that we are talking about.

But it is healthy to have an outside review made, and I think that, in this case, that review, as I said, inevitably will affect other aspects of the NASA operation that are not encompassed within the Foreign National Access Management.

Mr. WOLF. Which is important, too, because I just saw a report this morning, "How to target NASA's \$2 billion opportunity." NASA's fiscal 2014 IT budget was around \$1.44 billion. So it is very broad.

Thank you, Governor.

Mr. THORNBURGH. Thank you, Mr. Chairman.

Mr. WOLF. I appreciate your good work.

Mr. Fattah.

COMPETITION BETWEEN NASA CENTERS

Mr. FATTAH. Thank you, Governor.

So you have done this analysis and at the heart of it is that NASA has hundreds of cooperative agreements, probably 600 or so, and has over 100 partners on the International Space Station alone, like—I had a meeting this morning with a number of people from Europe, the European Space Agency. I mean, there is a lot—you know, there are a lot of moving parts here.

At the heart of what you are saying is that—when you glean through it all, is that what needs to happen is that there needs to be an actual program with policies and people that look agency-

wide at NASA's interactions with our international partners and individuals who are not American citizens. And that NASA—whose Administrator agrees with you and who—we are going to hear from momentarily, should move forward with implementing this. And NASA, as the heart of our space effort and the premier space agency in the world, has been engaging its partners in and around these issues.

We want to do that, obviously, with common sense, and we want to apply appropriate security protocols to each and every activity that this agency and other agencies are engaged in.

So I want to thank you for your work. I think it is instructive and will be helpful to NASA. And I am happy that there is both the report and the agreement to proceed.

I do have one question. Part of one of your recommendations is this issue around what you refer to as unnecessary competition between NASA centers.

Now, in Philadelphia, we don't have a NASA center. In Pennsylvania, we don't have a NASA center. It is not a parochial matter for me at all.

In terms of space exploration, however, there is a certain scientific rigor that is applied, and competition has always been believed in our country to bring out the best and that the idea of—as in with our national labs all over the country, there are various forms of engagement and advanced manufacturing issues. Right?

And they are, by their design, competitive one to another for various purposes because it—you know, it brings—in terms of recruiting the best people, having the best leadership, and getting—most importantly, when you talk about sending human beings, for instance, to Mars, getting it right. Right? Getting it right.

Sometimes—the same way that your report brings a different view on questions, competition between these centers at NASA brings a different approach to solving technological challenges.

So I want you to just—that is my only question, as to whether you think, one, eliminating this competition, which is a way to deal with one problem, could potentially challenge us in terms of making sure that we continue to lead the world in terms of space exploration and technological advancement.

Mr. THORNBURGH. I think that we have got to make a distinction here that is important in terms of the impact of competition.

When you look at—there is healthy competition and there is non-healthy competition, and I think the latter is exemplified when you have a heavily stovepiped operation, that is to say, that what is done in sector A is not within the purview of what is done in sector B, C, D, et cetera.

And the worry is that with—that kind of effort being expended to ensure that a particular operation is number one could well better be spent on efforts to secure real cooperation, at the very least, to have a clearinghouse to ensure that potential competitive forces that might exist down the road are checked and reined in before they carry the day.

The problem of stovepiping is compounded by the problem of competition. Let me put it that way. I think that, to that extent, not only, as you pointed out, are there savings available, but there is also a cultural change.

The matter of dealing with this problem of competition is a challenging one, and it is going to require some extraordinary leadership to break down some of those walls that exist when you have got an operation that is stovepiped.

And I suspect I would be very surprised if the Administrator didn't agree with us fully and wholeheartedly that this kind of—

Mr. FATTAH. I think he does. But, you know, the—I think it is the Felzian (ph) mind, right, is about holding two intellectually opposing views at the same time.

And I just want to challenge—I know that the Administrator agrees. I still want to challenge the point.

Joe, can I ask you a question? So what is the utility—the positive side of the competition between the NASA centers for the mission of NASA?

Mr. THOMPSON. If I could, I think the important distinction is when you are competing in technological areas as opposed to administrative processes, I think that is the distinction the panel drew, where competition does improve the breed when it comes to developing technology. But when we did our study and we visited these NASA centers, we would see a center struggling with an issue that another center had already solved with the same exact process in front of them and we didn't see that sharing.

The reluctance seemed to be that, in one case there is a lot of competition between NASA centers. I don't think that will surprise anybody on the committee—that reluctance to share information will strengthen someone else and a reluctance to say "I need help" will make me look weak. So I think that kind of psychology was driving what we the panel referred to as unnecessary competition. A lot of competition is good, but—

Mr. FATTAH. I visited NASA headquarters—right?—I would say a year ago—and I sat in on one of these reviews where they had everybody from all the centers. Nobody knew I was coming; so, you know, it wasn't put on for me.

This was a regular meeting in which they went through issue by issue area, and they had all center directors, had all the top leadership staff.

It seemed to be a very, you know, rigorous and sharing process in which people were talking about how they were solving problems.

So I will dig into this a little bit more. I want to thank you for the report, thank you for your service to the country.

And I thank the chairman. I yield back.

Mr. WOLF. Thank you, Mr. Fattah.

I just want to stress again we have tried to be very delicate on this.

But if you read the Governor's report, it said: The Academy found there was little accountability for noncompliance when identified through specific incidents or periodic assessment.

Mr. WOLF. Another thing it says: Due to the fact that NASA's systems lacked the necessary controls to protect information, allowed foreign nationals access to the networks, and allowed remote access, the panel concludes that NASA networks are compromised.

It goes on to say: NASA's headquarters officials and center directors have not adequately communicated that strict compliance is needed.

Another thing it said: Directives and orders can be seen more as guidance as opposed to mandatory policy.

Another thing it says: After fixing a problem, the agency has a tendency to lapse back in to bad habits.

Another sentence says: A number of the NASA leaders also noted the agency tends not to hold individuals accountable.

Another sentence says: Certain NASA centers take a more *laissez-faire* approach with training.

It is on and on.

I think a lot of this should have been released. But NASA said we shouldn't do it, and I took them at their word.

But this is serious. This is not just a little competition between the junior varsity and the varsity. This is serious. And so I urge the gentlemen, read the report.

NASA, at first, didn't want to go here but because of my respect for NAPA, having used Governor Thornburgh on the transition in the FBI, his record from Pennsylvania I felt he is an objective person, analytical, but also with a history.

So this was serious. Now, that is why I think we are going to direct that NAPA be involved in any follow up. I don't want to pick another person from outside to make sure that it is followed up. We have not tried to hurt anybody. We have tried to do this based on information to protect the country.

With that, Mr. Harris.

BALANCING SCIENCE WITH SECURITY

Mr. HARRIS. Thank you very much.

And thank you, Governor, for appearing before us.

Let me delve a little bit into the stovepiping idea because, with regards to security, clearly stovepiping has some benefit with security.

I mean, you don't have access to the entire system, you know. With Target credit card fraud, I mean, you know, an HVAC subcontractor had access to the entire Target system.

So when you talk about the need to eliminate stovepiping, I take it as mainly to guard the security, but not necessarily as an IT solution to the problems.

Mr. THORNBURGH. Maybe what I am referring to is the processes that are used to ensure that the rules and regulations that have been adopted and set forth are observed. It is very difficult to do that sometimes. You don't have the cooperation of the people who are on site at the particular stovepipe in question.

And we did find that that was an extant fact here within NASA and that there was a price to pay for it. And particularly all of this is compounded by the charter admonition to involve people from other countries, friends and foes.

And I think that what we have got to do beginning with the identification of the problem—and I think Joe stated very well the distinction between the administrative side and the science and technology side where you find a great deal of innovative practice which characterizes NASA—has characterized NASA from its very

beginning on the technological side, but, in many cases, pretty much close to a shutdown when it comes to the administrative side, particularly when it comes to sanctions.

We have identified in the record examples of where a violation of rules and regulations was not followed up with any particular sanction. It was not part of the message, and it has got to become part of the message.

Mr. HARRIS. Let me just ask—just historically speaking, you know, the origins of the space program were—I imagine, at the beginning, there was probably far more security as science—for the sake of science was less of an objective than science to beat the Soviet Union into outer space.

Is that—over time, I mean, is it reconcilable if you don't—and I will use—bar the term seque—if you don't sequester defense-related potentially, you know, technology for weaponizing space, if you don't put that off to the side, I could see where it is just difficult to achieve the balance that you seek, which is sharing what is good to share with foreign governments and protecting what is not good.

I mean, is it—I am going to ask you: Is it really possible to do that, to create that clear a firewall?

Mr. THORNBURGH. Yeah. I am not sure I am technically competent to answer that question in particular.

But let me counter by observing that what our restriction—what our recommendations are designed to do is to establish a workable framework within which this program—and I specifically identify it as a program in the hope that that is what will result—can be carried out with due respect to the somewhat conflicting nature of the charge that is given to NASA.

And I have no doubt but what—they are capable of doing that, and I think it is a matter of just changing the culture. We ran into numerous occasions where palpable violations had taken place with regard to what the policy of NASA was with regard to particular activities and nothing happened.

Mr. HARRIS. And let me just follow up.

Mr. THORNBURGH. And when that happens within an organization—excuse me—

Mr. HARRIS. Sure.

Mr. THORNBURGH [continuing]. That message travels at warp speed.

Mr. HARRIS. Sure.

And just—in those instances—and I will close with this question: Was the feeling that it was just carelessness or was it a feeling that, you know, “This is science and we really shouldn't have these boundaries”?

I mean, was it—in other words, was it carelessness or was it, you know, well intentioned, but just the wrong thing to do?

Mr. THORNBURGH. It is probably both. And I don't think either of them should be looked at other than in a serious way, that if there is a *laissez-faire*, as my French coach here identified for us, attitude, that that is going to have an effect that transcends what the particular project is. And it sends a message that is not a healthy one.

Mr. HARRIS. Thank you very much.

Yield back.

Mr. WOLF. Thank you, Mr. Harris.

Mr. Diaz-Balart.

COUNTERINTELLIGENCE AWARENESS AND EDUCATION

Mr. DIAZ-BALART. Thank you, Mr. Chairman.

I actually just want to just add my support to what the chairman was saying a little while ago. These are big issues. These are not small, unimportant issues. And so I just don't want to repeat what he said, but I just want to make sure that I am on record kind of also just saying and agreeing to what he said.

What kind of information are foreign governments or foreign entities actually trying to gain through their activities, through these espionage activities?

What is it specifically that they are trying to gain? Do we know? Is it anything specific? Is it—what is it—what is their goal?

Mr. THORNBURGH. Well, let me say at the outset I am a little bit constrained by the fact that the report and our work is not in the public domain. It is, of course, in your domain. And I—

Mr. DIAZ-BALART. Let me reword it.

Do we know what, in essence, those goals are? We are pretty sure what they are looking—in other words, are we pretty sure what it is that they are looking for, what their areas of interest are?

Mr. THORNBURGH. Well, there are counterintelligence considerations that are within the charter of NASA, and those folks clearly are charged with the responsibility of answering that very question.

I don't presume to know as much as could be produced from that kind of an investigation other than to realize and emphasize that this is not an exercise in checking the boxes and coming up with some recommendations.

In the quest for best practices in the administrative side, inevitably, you are going to have to answer those kinds of questions.

And, as we suggested in our report, the first step to be taken is to analyze the most important of the assets that NASA has, which might be compromised.

Because, clearly, while we have identified all of these as being serious matters and big issues, it doesn't involve any kind of magic with regard to determining where the primary effort should be put, but it does require a recognition that these are important matters and a respect for the product calls that have been adopted from time to time and a review of those product calls from time to time to see that every step possible is being taken to protect our national interests.

Mr. DIAZ-BALART. If I may, Mr. Chairman, just very briefly—and it was already touched upon, but—the fact that some of the findings say that the counterintelligence awareness briefings do not seem to be a priority and that counterintelligence and awareness and education at the centers and at headquarters varies greatly, with some being ineffective, are you convinced that that will change? And is it something that, again, is going to—how much of a priority is it to you and to leadership there?

Mr. THORNBURGH. Well, I think it is a high priority in terms of the recommendations that we have made. As to whether they are implemented or not, I think you will have to ask the witness following. He is nodding his head vigorously; so, I am sure that that is going to happen.

The important thing to recognize here is you have got a real world that you live in out there and that real world is made up, to be sure, in part of people for whom it is productive for us to cooperate, productive for us to share information, productive for us to follow the same kinds of paths that they are in their research on highly technical substantive matters.

But it is also important to realize the kind of world we live in and the shifting allegiances that we have among some of our prospective foreign partners. And prudence, it seems to me, if nothing else, dictates that you have a program where you have systematized your quest for rooting those people out or shutting practices down that give rise to sharing of the type that we are not really willing to undertake on our own.

Mr. DIAZ-BALART. Thank you. Thank you, Governor.

Thank you, Mr. Chairman.

Mr. WOLF. Mr. Culberson.

ACCOUNTABILITY

Mr. CULBERSON. Thank you, Mr. Chairman.

Governor, thank you for your work on this really important problem.

To you-all's knowledge, has anyone been held accountable at NASA for their breaches of these policies and—have they been held accountable in any way?

Mr. THORNBURGH. Within the NASA organization?

Mr. CULBERSON. Yes, sir.

Mr. THORNBURGH. Not to my knowledge. I would have to ask Joe.

Mr. THOMPSON. I can't speak to it. I don't know.

Mr. CULBERSON. No consequences of any kind that you are aware of?

Mr. THORNBURGH. Not that we know of.

And on the contrary, a kind of uneasiness among key staff people over the fact that things have happened that have not gone—

Mr. CULBERSON. Sure.

Mr. THORNBURGH [continuing]. That haven't been sanctioned.

Mr. CULBERSON. A lot of wonderful people at NASA. A lot of patriots.

Mr. THORNBURGH. Absolutely.

Mr. CULBERSON. Devoted public servants.

Mr. THORNBURGH. That is always the risk when you begin to carry out a review like this—

Mr. CULBERSON. Sure.

Mr. THORNBURGH [continuing]. Is it doesn't reflect on the incredible work that NASA has done over the years and that it has on its agenda now.

Mr. CULBERSON. Absolutely.

Mr. THORNBURGH. Our job—we are a National Academy of Public Administration. We are not a national academy of NASA.

And when we look at public administration questions of the type that we have discussed here this morning, we do find deficiencies and have made recommendations accordingly.

Mr. CULBERSON. You are looking for best practices?

Mr. THORNBURGH. Yep. We would hope.

Mr. CULBERSON. Right.

Mr. THORNBURGH. Not sure that is always the case, as stovepiping is the big enemy there.

Mr. CULBERSON. Right.

I mean, to my knowledge, no one has been fired yet for 9/11 or held accountable. I can't think of anybody that has been fired for 9/11 or held accountable.

It is an appalling characteristic of the Federal Government that—the utter inability of the agencies, the bureaucracy, to hold anybody accountable.

You always want to reward folks for doing a good job. But as what happened in the private sector in a heartbeat, nobody is held accountable, it is difficult to reward folks, intensely frustrating. And as you point out in your conclusions, the Agency has a tendency to lapse back into old habits once the spotlight is off. It is just grim.

Mr. THORNBURGH. Yes.

Mr. CULBERSON. I would certainly encourage the chairman to find an account somewhere somehow that is of importance to the Agency and fence it off until the Agency comes into compliance with your recommendations to make sure that you guys are brought into this in the future.

It is just appalling. Because we grieve. I mean, no one—this subcommittee genuinely loves and supports NASA—we all do—in the sciences, and want them to succeed.

And it grieves us, I know, as it grieves you, to see errors like this either—whether it is negligence or willful benign neglect, whatever the reason. Serious, serious breaches of highly important technologies occurred repeatedly with no consequences.

If the question is what have they done—what is the purpose of the breaches, something you can't necessarily answer in this public setting, I can certainly on my behalf as an individual, based on my own personal knowledge—and I have been an amateur astronomer since I was 12 years old, and I grew up in Houston, Texas. The astronauts in the Apollo program have been a vital part of my life since—as long as far back as I can remember.

And just based on my own knowledge and research and work, what would seem to me to be the reason you have got foreign nationals penetrating NASA headquarters and breaching their IT systems and probably have already installed—as the chairman said, they have probably installed Trojan horses programs to broadcast information back to whoever planted it.

I can tell you based on my own knowledge that—for example, one of my hobbies is observing artificial satellites, and I subscribe to a network of amateur observers around the world called SeeSat, S-e-e-S-a-t. And these guys are serious.

And the brass ring is if they spot the rocket when it comes over the horizon just after it is launched. And one of these guys actually

did the analysis and tracked the North Korean launch of December 12th of 2012.

And the North Koreans—very few people know this, but it was out there in the public arena. This guy broadcast—he was from British Columbia, and he did the calculation.

And the North Koreans launched an intercontinental ballistic missile that carried a payload and it flew right over Florida, the southern United States on its first pass, flew over Michigan, flew over South Carolina, flew over—I am sure in one of its second passes it flew over Pennsylvania.

But it is terrifying when you see what they have done. And the only reason the North Koreans are doing it, of course, is to carry—it is just, you know, logical—one of their nuclear warheads and set it off over the United States at an altitude of, you know, 30, 40, 50 miles, and then you have burned out every electrical circuit in the United States and driven us back to the year 1813 in a flash.

And the North Koreans—so they have already—the North Koreans have demonstrated their ability to hit the United States with a nuclear weapon, with an intercontinental ballistic missile.

And the North Koreans' number one ally, number one source of funding and support, are the Communist Chinese. And the chairman has quite rightly over the years zeroed in on the threat from the Communist Chinese and their aggressive attempt to dominate the high ground.

Because outer space is the high ground of the 21st century. And for us to surrender the high ground would be as idiotic as if General Meade had deliberately walked away from Little Round Top at Gettysburg. It just makes no sense.

The Chinese today control 98 percent of the world's rare earth elements, and the place that they landed on the moon is one of the most densely—there are more rare earth elements in that location where they landed that unmanned spacecraft than anywhere else on the moon.

So this is not—these penetrations are not—if anyone at NASA thinks this is being done—“Well, it is science and we need to be able to share” and, you know, maybe a little benign neglect, you know, “Let these guys come in and look,” no. This is deadly serious, really dangerous stuff.

The North Koreans are crazy, and they have said flat out they are going to—you know, we are still at war with them, technically. There has just been an armistice.

And they have already said they are going to use their nuclear weapon against us as soon as they get a chance to do so. They have already demonstrated they can do it.

They have overflowed the United States. That payload is still in orbit. And they just did another test, I think, recently.

So it is of immense concern. This is a vitally important report that you have prepared, and I just genuinely thank you for the work that you have done.

And thank you, Chairman Wolf, for your attention to this.

And I'm keenly interested to hear from the NASA Administrator about what the Agency will do to not only hold people accountable for their breaches, but, obviously, to reward those. Because, you

know, it works both ways. Folks that do a great job, you want to see them rewarded.

But those who have violated their own internal procedures, I would be really interested to know what they have done to hold them accountable.

I genuinely appreciate what you have done, sir.

And if I could, just in closing, could you—if you could, what, in your opinion, would be a worthwhile—what came to your mind as you went through and prepared this?

What would you recommend to the committee and to the Congress to do to make sure that we repair these breaches for the future? What could we do to help minimize the chance this will happen again?

Mr. THORNBURGH. I think careful, critical examination of this report and the Administrator's response will suggest a path that should be followed not only in the Congress, but within the Agency itself, to solve some of these problems.

And they are serious problems. I hope I didn't leave the impression that I regard them as anything but serious. Fine distinctions have to be drawn, to be sure.

For example, I mean, if you have got a criminal enterprise being undertaken by a foreign national or by his or her government, that is quite a different matter than the management challenges that we are talking about here.

On the other hand, the management challenges would be important—meeting those challenges would be important contributors to helping to create a kind of a safe haven for those things that we—the crown jewels, if you will, the things that you really want to protect. Those have to be identified and particular programs undertaken to see that they are protected from any foreign intrusion.

Mr. CULBERSON. Thank you very much.

Just one quick question, Mr. Chairman.

Who classified the report as sensitive? NASA?

Mr. WOLF. NASA. Yes.

Mr. CULBERSON. Yeah. Essentially because it is embarrassing.

Thank you, Mr. Chairman.

Mr. WOLF. Governor, I want to thank you, Mr. Thompson and all of the NAPA people for the great job. And thank you for your service to the country, too.

Mr. THORNBURGH. Thank you.

As always, we stand ready to respond to any further interests that you have in drawing on the experiences.

Mr. WOLF. We will. Thank you very much.

ADMINISTRATOR BOLDEN'S OPENING REMARKS

Mr. WOLF. We are now going to call Administrator Bolden to come forward.

Welcome, Mr. Administrator.

Consistent with the subcommittee's practice for Federal witnesses and according to the authority granted in Section 191 of Title 2 of the U.S. Code and clause 2(m)(ii) of House Rule XI, the Administrator will be sworn in before testifying.

Mr. Bolden, will you please rise and raise your right hand?

[Witness sworn.]

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

Administrator Bolden, your written statement will be made part of the record. You can proceed as you see appropriate. But welcome. Thank you.

Mr. BOLDEN. Mr. Chairman and members of the subcommittee, I first want to thank you, Ranking Member Fattah, and all members of subcommittee for the final fiscal year 2014 appropriation, which is allowing us to make substantial progress on our shared priorities.

Our fiscal year 2015 request builds on that appropriation. The President's \$17.5 billion budget request affirms a bipartisan strategic exploration plan agreed to with Congress in 2010, and it keeps NASA on the steady path we have been following, a stepping-stone approach to meet the President's challenge of sending humans to Mars in the 2030s.

The International Space Station remains our springboard to the exploration of deep space and Mars. Our commitment to extend it until at least 2024 ensures we'll have a unique orbiting outpost for at least another decade. This means an expanded market for private space companies, more groundbreaking research and science discovery in microgravity, and opportunities to live, work, and learn in space over long periods of time.

Astronauts aboard the ISS are helping us learn how to safely execute extended missions deeper into space. Later this year, we will see Exploration Flight Test 1 of Orion. NASA is pressing forward with development of the Space Launch System and Orion, preparing for an uncrewed mission of the two together in fiscal year 2018.

The budget also supports the administration's commitment that NASA be a catalyst for growth of a vibrant American commercial space industry. Already, two companies, SpaceX and Orbital Sciences, are making regular cargo deliveries to the Space Station. Later this year, we'll move beyond commercial cargo and award contracts to American companies to send astronauts to the Station from American soil and end our sole reliance on Russia.

If Congress fully funds our fiscal year 2015 request, we believe we can do that by the end of 2017. Unfortunately, due to reduced funding in the past few years, NASA will need to extend our current contract with the Russians and purchase more seats on the Soyuz spacecraft. Instead of investing millions of dollars in the U.S. economy to support American jobs, we'll be spending that money in Russia.

While I appreciate all of the funding this subcommittee has provided in recent years, I ask that you fully fund our 2015 request for this critical priority. Budgets are about choices. The choice here is between fully funding the request to bring space launches back to American soil or continuing to send millions to the Russians. It's that simple.

In addition to continuing ISS research, strengthening partnerships with commercial and international partners, and building the next-generation heavy-lift rocket and crew capsule to take our astronauts farther into space than ever before, our stepping-stone approach includes a plan to robotically capture a small near-Earth as-

teroid and redirect it safely to a stable orbit in the Earth-moon system where astronauts can visit and explore it.

Our asteroid-redirect mission will help us develop technologies, including Solar Electric Propulsion, needed for future deep space missions to Mars. We also enhance detection and characterization of near-Earth objects and improve our understanding of asteroid threats to planet Earth.

NASA's fiscal year 2015 request continues support for Science missions, heading toward destinations such as Jupiter and Pluto. It enables NASA to continue making critical observations of Earth and developing applications to directly benefit our Nation and the world. It maintains steady progress on the James Webb Space Telescope toward its 2018 launch.

Our Aeronautics program will continue to focus on substantially reducing fuel consumption, emissions, and noise to help make the Next-Generation Air Transportation System, or NextGen, a reality.

All of NASA's investments help drive technology and elevation, spur economic activity, and create jobs. That's why the President's Opportunity, Growth, and Security Initiative, with congressional approval, will provide NASA nearly \$900 million in additional funding in fiscal year 2015 to focus on specific areas where we can advance our priorities.

Finally, Mr. Chairman, I want to thank you and this subcommittee for sharing my deep concerns about security issues. Following up on the progress we discussed at last year's hearing, the NAPA study team, led by Governor Thornburgh, completed a thoughtful and thorough review of NASA's foreign national access controls. And you just heard from Governor Thornburgh on that report.

As he said, I have accepted all—all 27—of the NAPA recommendations, and we are making good progress in implementing them in a lasting manner. Consistent with the report's recommendations, NASA has established a Foreign National Access Management Program to strengthen our foreign national oversight, including efforts to ensure compliance with U.S. Government export control policies.

I have repeatedly communicated the importance of the NAPA report and NASA's corresponding actions to all of my senior managers. I am now in the process, along with Associate Administrator Robert Lightfoot, of visiting each NASA center and underscoring the importance of security to our entire workforce.

In summary, the fiscal year 2015 budget advances NASA's strategic plan for the future. We will continue building U.S. Pre-eminence in science and technology, improve life on Earth, and protect our home planet, while creating good jobs and strengthening the American economy.

Thank you, Mr. Chairman. I'll be happy to respond to any questions.

Mr. WOLF. Thank you, Mr. Administrator.

[The information follows:]

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UNTIL PRESENTED
BY WITNESS
April 8, 2014

**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 discuss NASA's FY 2015 budget request. The requested budget of \$17.46 billion provides the resources NASA needs to pursue the goals and priorities that the Congress and the Administration have established for the Agency and will ensure that NASA will remain the world's leader in space. A summary of the FY 2015 budget request is appended to this statement.

The President's FY 2015 request supports NASA's continuing quest to extend human presence into deep space and on to Mars. NASA will continue to perform research aboard the International Space Station (ISS), partner with American industry for crew and cargo delivery to low Earth orbit (LEO), develop the Space Launch System (SLS) and Orion crew vehicle, and test our new capabilities in the proving ground of cis-lunar space before sending a human mission to the Red Planet. NASA will also continue to develop a rich array of commercial and international partnerships as part of its overall exploration framework. As we speak, American astronauts aboard the ISS are learning the fundamental lessons necessary to safely execute extended missions deeper into space. Later this year we will see the Exploration Flight Test-1 (EFT-1) of Orion atop a Delta IV Heavy launch vehicle. NASA is pressing forward with development of SLS and Orion, preparing for a first, uncrewed mission in FY 2018.

As a critical element in this long-term exploration strategy, as well as a source of continuing scientific and material benefits to life on Earth, operations in LEO remain among NASA's highest priorities. With the Administration's commitment to the extension of ISS operations through 2024, NASA looks forward to expanded research opportunities with continuing support from our commercial partners for both crew and cargo. Two American companies are launching supplies to the ISS from U.S. soil. NASA will complete a commercial crew competition this summer, and if Congress fully funds our FY 2015 budget request, we believe we can stay on track to launch astronauts to the ISS from American soil by the end of 2017. This capability is critically important to safe/sustained operations, and will end our sole reliance on our Russian partners for this service. The requested funding is required to meet this critical near-term need.

Consistent with the 2010 NASA Authorization Act (P.L. 111-267) and the National Space Policy, NASA continues to make solid progress on the development of SLS and Orion for a series of test flights including a compelling mission in the proving ground of cis-lunar space to redirect a small asteroid into orbit around the Moon, and to send U.S. astronauts to rendezvous with and explore

this target. The proving ground of cis-lunar space also puts the Nation in a position from which we may help our commercial and international partners robotically explore other destinations on that pathway, such as the Moon.

The Asteroid Redirect Mission (ARM) will enable NASA to test powerful Solar Electric Propulsion (SEP) and integrated human/robotic vehicle operations in deep-space trajectories. Like the invaluable ISS, this mission will provide NASA with critical knowledge, experience and technologies for future human exploration missions deeper into space. Drawing on our long-term investments across three Mission Directorates, the FY 2015 request supports continued core capability development and formulation of the integrated mission concept. The overall asteroid initiative also includes enhanced Near Earth Object (NEO) detection and characterization, which will extend our understanding of the NEO threat while providing additional opportunities for investigations of asteroids and demonstrations of technologies and capabilities.

NASA's FY 2015 request for Science supports operation of the world's premier constellation of spacecraft dedicated to exploring Earth, the solar system, and the universe beyond, while we continue to develop the next generation of missions in pursuit of our Nation's highest priority space and Earth science. The James Webb Space Telescope (JWST), NASA's next-generation successor to the Hubble Space Telescope (HST), continues on schedule for its 2018 launch. In recent months, NASA has completed rigorous testing of the spine of the massive telescope and completed the primary mirrors for integration. As we announced last year, we have begun work on a large Curiosity-scale rover for a 2020 mission to Mars, and the FY 2015 request includes funding to continue pre-formulation activities of a potential mission to Europa, one of Jupiter's moons believed to harbor a vast subsurface ocean. NASA will launch five Earth science missions in calendar year 2014, taking advantage of the unique vantage point of space to secure new insights into our home planet. The Earth science budget will support airborne campaigns to the poles and hurricanes, development of advanced sensor technologies, and use of satellite observations and data analysis tools to improve natural hazard and climate change preparedness.

With NASA's FY 2015 request, our pioneering Aeronautics research program will continue to focus on substantially reducing aircraft fuel consumption, emissions, and noise – and help make the Next Generation Air Transportation System, or NextGen, a reality. NASA's Aeronautics Research Mission Directorate (ARMD) will continue to implement the strategic vision for aeronautics that NASA launched last year, with a focus on addressing the challenges facing the U.S. aviation community – civil and military – in the coming decades.

In essential support of the Agency's broader mission, the FY 2015 request supports an active Space Technology Program to advance cutting-edge technologies, providing an on-ramp for new space technologies, creating a pipeline that matures them from early-stage through flight, and delivering innovative solutions that dramatically improve technology capabilities for NASA, the aerospace sector, and the Nation. The request supports the sustained investments that NASA must make to mature the capabilities we need to achieve the challenging goals that the Congress has set for us. By the end of FY 2014, NASA will test and deliver two candidate designs for high-power solar electric systems for SEP with critical applications for deep-space exploration as well as for Earth-orbital activities. By the end of calendar year 2015, NASA will have completed seven Space Technology missions in 24 months, including demonstration of a deep-space atomic clock for advanced navigation, the green propellant demonstration (an alternative to highly toxic hydrazine), a solar sail to demonstrate propellant-free propulsion, and four small spacecraft missions pioneering new technologies. The Space Technology Program is also developing high performance systems for decelerating spacecraft at Mars, high bandwidth laser communications with the potential to transform communication systems for both space exploration and

commercial use, advanced life support technology, advanced robotics, and lightweight composite propellant tanks.

The program laid out in detail in NASA's FY 2015 request continues NASA's implementation of the priorities established for it in the bipartisan NASA Authorization Act of 2010. In the current constrained budget environment, we have designed a balanced program that pursues the Nation's highest priorities in science, exploration, and aeronautics; with a critical technology development program to develop essential capabilities. The FY 2015 request supports the next steps on the way to Mars in a sustainable way. It enables NASA to restore an American capability for sending humans to orbit while continuing development of a deep-space capability for human space flight. This is not an either-or scenario. Each is critically dependent on the other. The request supports the Nation's highest priority science and technology goals for space. NASA appreciates the strong budget support the Agency has received despite a difficult budget environment, and we are fully committed to delivering the world's leading space program on behalf of the American people.

NASA is pleased to be included in the President's Opportunity, Growth, and Security Initiative (OGSI). Under this initiative, NASA would receive nearly \$885.5 million in additional funding in FY 2015 to focus on specific priorities. This initiative recognizes NASA as a critical source of innovation and technology that creates opportunity, economic growth, and ultimately security and prosperity. NASA's funding under OGSI would focus on priority investment opportunities such as an expanded Space Technology Program, reducing risk and enhancing competition in the Commercial Crew Program, continuing currently operating science missions and accelerating work on potential future missions. NASA's portion of OGSI would also enable further development work on SLS and Orion, more fully utilize the ISS, and support additional Earth Science mission development, advanced computational fluid dynamics research and increased investment in composite materials.

Science

With 95 missions in development and actively observing Earth, the Sun, the planets, and the universe beyond, NASA remains the world's premier space science organization and the critical source of information on the home planet. The President's FY 2015 budget request for the Science program includes \$4,972.0 million, with \$1,770.3 million for Earth Science, \$1,280.3 million for Planetary Science, \$607.3 million for Astrophysics, \$645.4 million for the James Webb Telescope, and \$668.9 million for Heliophysics.

Earth Science

The President's FY 2015 budget request enables NASA to continue to make critical spaceborne measurements of Earth, our home; to conduct and fund a comprehensive, competed scientific research program to turn those measurements into an understanding of our complex planet; and to use the measurements and understanding to develop and demonstrate applications that will provide direct benefit to our Nation, and indeed all of humanity. Today, there are 17 NASA-developed research satellites on orbit, making measurements of more than 60 key aspects of our planet's environment. Just a few weeks ago, in collaboration with the Japan Aerospace Exploration Agency (JAXA), the Global Precipitation Measurement mission (GPM) was launched to provide the first-ever, accurate, global maps of rain- and snowfall over the globe. During the rest of 2014, NASA will be launching four more Earth observing research missions: Orbiting Carbon Observatory-2 (OCO-2) to measure global carbon dioxide concentrations with unprecedented coverage and accuracy; RapidScat to the ISS, to make measurements of ocean wind speed and direction; Cloud-Aerosol Transport System (CATS), also to the Space Station, to measure atmospheric aerosols; and, in November, the Soil Moisture/Active Passive (SMAP)

mission to make accurate measurements of soil moisture and freeze-thaw cycling. These 2014 missions will be followed in 2015-2017 by the SAGE-III (Stratospheric Aerosol and Gas Experiment III) instrument to the ISS for atmospheric trace gas profile data, including ozone measurements; the Gravity Recovery and Climate Experiment (GRACE)-Follow On gravity mission with our German partners to measure changes in the Earth's gravity field and water storage, such as aquifer level changes; a constellation of eight smallsats, called Cyclone Global Navigation Satellite System (CYGNSS), to use reflected Global Positioning System (GPS) signals to measure conditions in cyclones and hurricanes; an instrument called Tropospheric Emissions: Monitoring of Pollution (TEMPO) to fly on a commercial geostationary communications satellite, to measure air quality over greater North America; and Ice, Cloud, and land Elevation Satellite-2 (ICESAT-2), to make precise measurements of our planet's rapidly changing ice caps and glaciers.

NASA is now developing the Pre-Aerosol, Clouds and ocean Ecosystem (PACE) ocean color and aerosol continuity mission, and the NASA-Indian Space Research Organisation (ISRO) Synthetic Aperture Radar (NI-SAR) mission in collaboration with the Indian space agency to measure solid earth processes, ice flows, global vegetation, and response to disasters and geohazards. The FY 2015 budget request also supports NASA to develop missions that will continue key climate data series, including a set of solar irradiance, ozone profile, and Earth radiation budget instruments, and follow-on capabilities in support of U.S. Geological Survey for sustained land imaging following our successful launch of Landsat-8 just one year ago.

Astrophysics and James Webb Space Telescope

NASA is making strong progress on JWST, the most powerful space telescope in history, and remains on cost and schedule for launch in 2018. The Webb telescope is the next in a series of astrophysics missions, including the venerable, yet still unrivaled, HST 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 Kelvin). The Webb telescope will allow us to observe objects even fainter than HST can see, which will allow us to study every phase in the history of our universe, ranging from the first luminous glow 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. The FY 2015 request will support work to continue testing the integrated science instrument module for JWST, continue the construction of the spacecraft that will carry the science instruments and the telescope, and begin the assembly of the delivered mirror segments into the telescope backplane.

NASA's Astrophysics Program operating missions include the Hubble, Chandra, Spitzer, and Kepler telescopes; and other missions that together comprise an unrivaled, and in many ways unprecedented resource for the study of our universe. NASA is currently working with our German partner to identify a path forward for the Stratospheric Observatory for Infrared Astronomy (SOFIA), a mission with high annual operating costs that cannot be accommodated within the FY 2015 budget request. In FY 2015, NASA's next two astrophysics Explorer missions will continue their development. The Neutron Star Interior Composition Explorer (NICER) will probe the interiors of neutron stars and determine the laws of physics that govern atomic nuclei. NICER will be launched to the ISS in 2016. The Transiting Exoplanet Survey Satellite (TESS) will extend the pioneering work of the Kepler Space Telescope, which showed us that virtually every star in the sky has a planetary system. TESS launches in 2017 and will discover rocky exoplanets orbiting the nearest and brightest stars in the sky in time for the JWST to conduct follow-up observations that will characterize their atmospheres and other properties.

Planetary Science

Planetary science missions continue to explore the solar system in unrivaled scope and depth. This past November, the Lunar Atmosphere and Dust Environment Explorer (LADEE) was successfully lowered into its optimal position in lunar orbit to enable science data collection. Using its ion engines, the Dawn spacecraft is nearing its next target, Ceres, the largest asteroid in the asteroid belt, with an expected arrival in April 2015. Other upcoming outer planet encounters include the New Horizons mission flyby of Pluto in July 2015 and the Juno mission orbit insertion around Jupiter in August 2016. The FY 2015 budget request also includes funding for continuing pre-formulation activities and studies for a potential mission to Jupiter's icy moon, Europa; with compelling evidence of a liquid water ocean beneath its crust, exploration of Europa is vital to our understanding of the habitability of other planets.

Building on the success of NASA's Curiosity rover on Mars, the FY 2015 request supports plans for a robust multi-year Mars program. In a little more than a year on the Red Planet, Curiosity has landed in an ancient river bed, determined the age of the surrounding Martian rocks, found evidence the planet could have sustained microbial life, taken the first readings of radiation on the surface, and shown how natural erosion could be used to reveal the building blocks of life protected just under the surface. Curiosity is providing vital insight about Mars' past and current environments that will aid plans for future robotic and human missions. The current Mars portfolio includes the Curiosity and Opportunity rovers, the Mars Reconnaissance Orbiter, the Mars Odyssey orbiter, and our collaboration on the European Space Agency's Mars Express orbiter. It also includes the new Mars Atmosphere and Volatile Evolution (MAVEN) orbiter, launched in 2013 to study the Martian upper atmosphere, which will arrive at the Red Planet in mid-September 2014. Future missions include 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.

The FY 2015 budget request includes enhanced funding for NASA's Near Earth Object survey and characterization activities in support of the ARM effort, as well as to protect our planet. Just last year, the Wide-field Infrared Survey Explorer spacecraft was reactivated, renamed NEOWISE and given a renewed mission to assist NASA's efforts to identify the population of potentially hazardous near-Earth objects (NEOs). NEOWISE's first discovery of its renewed mission came on December 29, 2013 – a large near-Earth asteroid designated 2013 YP139, which was about 27 million miles from Earth with an estimated diameter of roughly 0.4 miles. NEOWISE can also assist in characterizing previously detected asteroids that could be considered potential targets for future exploration missions.

Heliophysics

NASA's Heliophysics Program is composed of 29 spacecraft and the associated research to understand the universal physical phenomena of magnetized plasmas and their interactions. These include the influence of the Sun in our local region of the galaxy, the origins of solar variability, and the coupling among various regions at the Earth and other planetary systems. Last year, NASA successfully launched the Interface Region Imaging Spectrograph (IRIS), a Small Explorer mission. Within a few months, IRIS provided a new understanding of how the outer solar atmosphere is heated to over a million degrees. The FY 2015 budget request will support completion of development of the Magnetospheric Multiscale (MMS) mission, which will launch in 2015 to investigate how magnetic fields connect and disconnect, often releasing tremendous amounts of energy in the process. NASA will continue to develop the Solar Probe Plus (SPP) mission for a planned launch in FY 2018, together with our instrument

contributions to the European Space Agency's Solar Orbiter mission; Solar Probe Plus will repeatedly pass through the hot outer atmosphere of the Sun, to within five times the Sun's diameter, which is much closer than any man-made object ever has flown before. Finally, the Explorer missions selected in 2013 to study Earth's outer atmosphere – Ionospheric Connection (ICON) and Global-scale Observations of the Limb and Disk (GOLD) – are in their preliminary design phases for planned launches in 2017.

Aeronautics Research

NASA's Aeronautics research is making air travel cleaner, safer, and more efficient. NASA's FY 2015 budget request provides \$551.1 million to fulfill the Agency's strategic research agenda. This innovative research is aimed at transforming the aviation industry through game-changing advances in the safety, capacity, and efficiency of the air transportation system, while minimizing negative impacts on the environment. NASA's FY 2015 research portfolio is aligned with six strategic research thrusts to directly address the growing global demand for mobility, severe challenges to sustainability of energy and the environment, and technology advances in information, communications, and automation technologies. This portfolio includes those activities in our current portfolio deemed to be the most relevant and critical, as well as new activities focused on high-risk, forward thinking ideas to address aviation's big problems. The Agency will clearly define the most compelling technical challenges facing the aviation industry, and retire these challenges in a time frame that is supported by stakeholders and required by NASA's customers. Over the next two years, NASA will continue to develop, demonstrate, and transition to industry and the Federal Aviation Administration new vehicle and airspace management concepts and technologies to help realize the promise of NextGen, as well as provide technical data, analysis and recommendations to support the integration of unmanned aerial systems (UAS) into the National Air Space. We will strengthen our external partnerships through joint flight experiments using alternative aviation fuels and advanced flight deck and vehicle technologies, and through demonstrations of advanced sensors to improve safety and identify emerging faults before damage occurs. By the end of FY 2015, NASA will close out the six-year Environmentally Responsible Aviation project with a series of integrated technology demonstrations to demonstrate the feasibility of a suite of technologies to meet our aggressive environmental goals. Through the alignment of our research portfolio to address the most critical challenges facing the aviation sector, NASA will be best positioned to continue supporting the global competitiveness of the U.S. aviation industry that contributes to a \$47 billion positive balance of trade, infuses \$1.3 trillion annually into the U.S. economy and supports more than 10 million direct and indirect jobs^{1,2}. NASA is truly with you when you fly.

Space Technology

NASA's FY 2015 request includes \$705.5 million for Space Technology, to enable our future in space, drawing on talent from the NASA workforce, academia, small businesses, and the broader national space enterprise, by delivering innovative solutions that dramatically lower costs and improve technological capabilities for NASA and the Nation.

By the end of FY 2014, NASA will test and deliver two candidate designs for large deployable solar array systems, power processing units, and advanced thrusters to support a flight demonstration of SEP. In addition to being important to the future of human spaceflight and the ARM effort, high-power SEP can enable orbit transfer capability for satellites, and addresses the

¹ "Global Aerospace Industry Takes Off for the World's Largest Aerospace Trade Exhibition in 2012," July 6, 2012, International Trade Administration.

² "The Economic Impact of Civil Aviation on the U.S. Economy," August 2011, FAA, Page 24, Table 5 and Page 27, Table 8.

rapid power demand increases facing today's communications satellites. Having successfully demonstrated a 2.4-meter propellant tank in 2013, NASA will complete testing a 5.5-meter diameter composite tank to enable lower-mass rocket propellant tanks for future systems, including the SLS. By the end of 2015, NASA will have completed seven Space Technology missions in 24 months, including demonstration of a deep-space atomic clock for advanced navigation that has commercial application for improving GPS systems, the green propellant demonstration (a higher-performing, less toxic alternative to hydrazine), a solar sail to demonstrate propellant-free propulsion, and four small spacecraft missions pioneering new technologies. Building on recent successes with its Low Density Supersonic Decelerator, NASA plans to conduct high-speed tests – at an altitude of 170,000 feet – of the largest planetary parachute ever developed to enable precise landing of higher-mass payloads to the surface of other planets, with particular focus on infusing advanced capabilities into the Mars 2020 mission and future human exploration missions.

NASA's Space Technology investments are aligned with NASA's Human Exploration and Operations and Science Programs to reduce technological barriers and mission risk, and to foster affordable missions. The Space Technology Game Changing Development effort is delivering advanced life-support, advanced robotics, and battery technologies for system demonstrations planned by Human Exploration and Operations. For Science, Space Technology is improving navigational accuracy, developing advanced computing and avionics, and developing advanced Entry, Descent, and Landing (EDL) solutions, observatory technology, and optical communication technology to transmit large amounts of science data from deep space. Space Technology is partnering with Human Exploration and Operations and Science on many activities, including demonstration of in-situ resource utilization, optical communications, and advanced measurements on Mars. These precursor activities will pave the way and reduce risk for future Mars exploration.

Exploration and Space Operations

NASA is building the capabilities and knowledge to send humans farther from the home planet than we have ever been before. The FY 2015 budget request for Exploration is \$3,976.0 million with \$2,784.4 million for Exploration Systems Development, \$848.3 million for Commercial Space Flight, and \$343.4 million for Exploration Research and Development. Space Operations, including the ISS and Space Flight Support, form a critical component of the Agency's exploration plans by enabling us to develop the knowledge, experience, and technology necessary for safely living and working in space. The FY 2015 request for Space Operations is \$3,905.4 million, with \$3050.8 for ISS and \$854.6 for Space Flight Support (SFS).

Exploration Systems

The FY 2015 request will enable NASA to continue to meet its milestones in the development of the Space Launch System (SLS), a rocket system ultimately capable of bringing an unprecedented 130 metric tons of payload to Earth orbit. The Orion program continues on track for an uncrewed test flight later this year. This test flight, Exploration Flight Test-1 (EFT-1), will see Orion conduct two orbits of Earth and reenter the atmosphere at approximately 85 percent of lunar re-entry speed of a returning deep-space exploration mission. The test will provide valuable data about the spacecraft's systems – most importantly its heat shield and structure. The flight test article for this mission is already in place at the Kennedy Space Center and being readied for this test. The FY 2015 budget request supports progress toward a first uncrewed test of the Orion and the SLS together, known as Exploration Mission-1 (EM-1) in FY 2018, with the first crewed mission of the two vehicles slated for FY 2021-2022. Orion, SLS, and Exploration Ground Systems (EGS) are using the latest in systems and manufacturing technology to develop the safe and sustainable systems this country needs to extend human presence to Mars. Examples include

Orion's use of time-triggered gigabit Ethernet, SLS' use of friction-stir welding on large structures to build the Core Stage, and EGS' replacement of cables from Pad 39B with the latest in fiber optics. In developing the Orion, SLS, and EGS, NASA is building a national capability for the long-term human exploration of space.

International Space Station

The FY 2015 request supports the ISS with its international crew of six orbiting Earth every 90 minutes. The Station is making deep-space exploration possible, as we build on the knowledge and experience we are gaining from the astronauts living, working, and conducting research on the ISS. On January 8, 2014, the Administration announced it is committing the United States to the extension of ISS operations through at least 2024. This will allow NASA to complete many of the research and technology development activities aboard the ISS necessary to enable planned long-duration human missions beyond LEO; extend the broader flow of societal benefits from research on the Station, which has already resulted in discoveries that could have significant medical and industrial implications; provide NASA and its private-sector partners time to more fully transition to the commercial space industry the transportation of cargo and crew to LEO; instill confidence in the science community that the ISS platform will be available for important, long-term research endeavors; and help cement continuing U.S. leadership in human spaceflight going forward. NASA's plans for the coming year include preparing for an extended duration, year-long human-crewed mission – slated to launch in March 2015 – to explore human adaptation to space; and continuing to utilize the ISS to improve our ability to live and work in space, including conducting technology demonstrations enabling future exploration. The Center for the Advancement of Science in Space (CASIS) continues to manage the National Laboratory research being conducted in the U.S. segment of the ISS by an array of organizations, including commercial researchers interested in taking advantage of this unique, microgravity facility. One company, NanoRacks, uses standardized hardware to provide a microgravity research option for scientists working in venues ranging from grade school to academia to industry. During its first three years of business, NanoRacks sent 91 investigations to ISS, returned 10 to Earth, and deployed one CubeSat – a new area of focus using satellites that measure about four inches on all sides.

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 sole 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 ISS, and Orbital Sciences Corporation (Orbital) was awarded 8 flights. Counting demonstration flights and CRS resupply flights, SpaceX has now completed three cargo missions to the ISS, successfully delivering cargo and returning scientific samples to Earth, with the fourth mission expected to launch later this month. Orbital Sciences Corporation has completed their demonstration mission to the ISS and their first contract mission under CRS to deliver crew supplies, research and other cargo onboard the Cygnus spacecraft. NASA continues to work with its commercial partners to develop a U.S. commercial capability for human spaceflight and plans to launch American astronauts from U.S. soil by the end of 2017. 2014 will be a pivotal year for NASA's Commercial Crew Program (CCP) as the Agency intends to award development and certification contract by August/September for the Commercial Crew Transportation Capability (CCtCap) phase that would lead to operational crewed flights to the ISS. Competition is a key to controlling costs over the long term, and NASA's Aerospace Safety Advisory Panel has opined that competition should be maintained until safety confidence is achieved. Through the successful execution of this partnership, we will return to the United States the vital capability to launch astronauts to the ISS from U.S. soil and return them to Earth.

Education

The Administration is proposing increased interagency coordination of Science, Technology, Engineering, and Mathematics (STEM) education investments, aligned with the Five-Year Strategic Plan released last year by the Committee on STEM Education (CoSTEM). The FY 2015 budget request for Education will enhance the impact of the Federal investment in STEM Education through greater interagency coordination and cooperation in support of a cohesive national STEM strategy focused on five priority areas: K-12 instruction, undergraduate education, graduate education, and broadening participation in STEM education and careers by women and minorities traditionally underrepresented in these fields, and education activities that typically take place outside the classroom. The Office of Education will continue its intra-agency consolidation of certain educational programs to eliminate duplication of efforts and achieve maximum leverage of resources.

The FY 2015 budget request of \$88.9 million consolidates education activities in the Office of Education, including several elements that may be transferred from NASA's mission directorates under a competitive process. The FY 2015 budget request for the Education account includes funding for the National Space Grant College and Fellowship Program, the Experimental Program to Stimulate Competitive Research (EPSCoR), and the Minority University Research and Education Project (MUREP), and STEM Education and Accountability Projects. These education investments link to NASA's research, engineering, and technology missions. Each of these investments provides unique NASA experiences and resources to students and faculty. The budget also provides \$15 million to the Science Mission Directorate to competitively fund the best application of NASA Science assets to meet the Nation's STEM education goals.

Conclusion

Mr. Chairman, thank you for the opportunity to appear before you today to provide you with our progress and status over the past year. I would be pleased to respond to any questions you or the other Members of the Subcommittee may have.

NASA'S IMPLEMENTATION OF NAPA RECOMMENDATIONS

Mr. WOLF. I don't want to spend much more time on the NAPA report, but there are one or two issues I want to cover.

The designation of "sensitive but unclassified" really was a blunt instrument because it covers the entire 140-page report, except for the 4-page summary, without regard to the specific contents of any particular paragraph or page. I believe that a more tailored redaction of the report would have resulted in substantial portions of it becoming releasable and, therefore, open for a detailed discussion today. And I am not going to ask you couldn't NASA have done it differently, because what happened has happened. But I think you used a blunt instrument, and I think the reasons for it have not been totally valid.

But I am more interested now in what you are going to do. You have not to date requested any additional resources for security. I want you to know that we are fully prepared, in order for you to follow the NAPA report, to reprogram—not to wait until next year, but to reprogram.

So what funding will be required to ensure full compliance with NAPA recommendations? And will there be a reprogramming? What are your plans?

How are you going to move ahead? Don't just say you like it, it is a good idea. The hard work begins Monday morning. What are we going to do? Do you need a reprogramming? Do you have a funding stream? How are you going to move ahead?

Mr. BOLDEN. Mr. Chairman, no one was more concerned about the vulnerabilities that were identified, first of all, within NASA long before the NAPA study was even requested. We knew we had some vulnerabilities.

One of the reasons for making the report unclassified but sensitive is the fact that, as Governor Thornburgh mentioned, there were a number of vulnerabilities that are pointed out in the reports, vulnerabilities that we knew about that, when taken in toto, opened NASA up to some of the things that this committee asked the Governor about, exposure of inroads to our systems. And that's not what we want to get out. So that's the reason. It wasn't embarrassing. I was disappointed that we found that we had vulnerabilities that I had not found when I first became the NASA Administrator.

But I think if you listen to Governor Thornburgh and if you read the report very thoroughly, he gave us 27 recommendations. We sat down with the board. We have been working with them from the moment—even before the report was put out. They gave us a prioritized list of recommendations based on risk, and they classified them in two groups. One was lifecycle cost; how do you divide it into what it's going to cost over the lifecycle of the agency. Then the other was initial cost, short-term budget considerations. We looked at that. The first six we agreed with the board could be done right away with no additional funds, and we are doing that. We have established a Foreign National Access Management Office. We are in the process of putting out a solicitation for someone to head that office. Until we do so, the person who worked with Governor Thornburgh and the board is the Acting Program Manager

right now. We have put some additional civil servants, as well as contractors, on taking actions to accomplish these first six goals. Those are just by reallocating people within the agency.

We don't know how much money is going to be needed to get to the other 21 recommendations. But it is our intent that, if we find, after we see what the 2015 budget is going to be—we don't know what 2015 is going to hold. You all may put a lot of money in there for IT enhancements, and then I don't have to worry about coming in to ask for more money. So until I see what the 2015 budget is going to be, I see nothing to ask for any adjustments.

We are doing things right now by making internal moves of our people and internal moves of our money. We have spent funds, we have reallocated funds that would have been spent on other things to take care of those first six recommendations. We will continue to do that.

So I share your concern, I share Governor Thornburgh's concern. I think if the members of the committee who were here heard him, he said we have been working like this, like this, all through the formulation of the report and ever since the report. We promised him and the board that we would interact with them a minimum of every quarter. We will give them a status of the progress we are making.

So your request that they should come back again, I think we have already taken care of. We are going to them. We are not waiting for them to come back. We are going to report to them every quarter on our progress. If they see that we are not making the progress they expect, I am certain they will tell us that. Then we may find that we need to ask for some adjustment earlier than possible. And I think we are taking aggressive actions to remedy problems that we found.

Mr. WOLF. Okay. Well, the committee would reprogram. We may not have a bill for quite a while. You are not going to have a bill Monday or Tuesday or Wednesday of next week or the week after. So if you do need it, just feel free to come up to the—

Mr. BOLDEN. Mr. Chairman, I will. We just don't need it right now. We don't need additional funds. We have, as I said, we have put, I think it's two to four contractors on this program, on standing up the program. Concurrently, only one civil servant from the Office of Personnel Security has been assigned the Acting Foreign National Access Program Manager.

So we don't have a need for funds right now. We will determine what we need as we look going forward.

Mr. WOLF. Okay.

I was concerned to read in NASA's quarterly report that the agency appears now to be pulling back on its support for two important recommendations made by NAPA: one, the creation of an asset protection oversight board to better secure all of NASA's export-controlled and proprietary information; and, two, periodic integrated function reviews to audit compliance and effectiveness of security reforms.

Are you rejecting—

Mr. BOLDEN. I am not aware of those, and I'll take—

Mr. WOLF. Well, that is in your quarterly—

Mr. BOLDEN [continuing]. That for the record, Mr. Chairman. I don't know—I will take it for the record. The report——

Mr. WOLF. So if you don't want to do what was in your——

Mr. BOLDEN. No, Mr. Chairman, as I said before, we agreed with all 27 recommendations, and we have committed to follow those recommendations and comply with them.

Mr. WOLF. Okay. Good.

Mr. BOLDEN. So that's why I say I'll have to take it for the record. If you have something that shows that I have changed my mind——

Mr. WOLF. We do.

Mr. BOLDEN [continuing]. Somebody needs to tell me. I have——

Mr. WOLF. We do.

Mr. BOLDEN [continuing]. Not changed my mind.

Mr. WOLF. We will show you that at the end of the hearing——

Mr. BOLDEN. Okay.

Mr. WOLF [continuing]. And you can just tell the people, whoever wrote it.

[The information follows:]

NAPA RECOMMENDATIONS

As stated by NASA Administrator Bolden, the Agency has accepted all 27 NAPA recommendations and is implementing actions to address them. With respect to the two recommendations referenced, the integrated functional reviews (NAPA Recommendations 17 and 22) and the asset oversight board (NAPA Recommendation 23), NASA concurs with the intent of these findings, but not with the recommended implementation. NASA currently evaluates sponsoring and requesting foreign nationals through its Integrated Functional Review Program. The Functional Reviews are conducted every three years, and are led by the NASA Office of Protective Services (OPS) and include representatives from the Offices of the Chief Information Officer (OCIO) and International and Interagency Relations (OIIR). The OPS, OCIO, and OIIR will review both the Integrated Functional Reviews and the CI/CT evaluations, and identify areas for expansion to address specific Foreign National Access Program Manager processes. The targeted completion date for these implementation actions is December 2014. For NAPA Recommendation 23, NASA will explore utilizing an existing council to serve as an Asset Protection Oversight Board. The target completion date for this implementation action is March 2015.

Mr. WOLF. Okay, I am moving on from NAPA, because I think we have covered a lot. We will have some questions for the record, but I want to cover a number of other topics.

ASTEROID REDIRECT MISSION (ARM)

Mr. WOLF. NASA's proposal for an Asteroid Retrieval Mission, ARM, remains vague, which complicates the committee's ongoing attempts to evaluate its merit. For example, NASA is already revisiting one of the fundamentals of the entire concept by considering the possibility of breaking a small piece off of a larger asteroid rather than capturing a small asteroid in its entirety.

When will you have a final mission concept proposal available for Congress? Also, how much is included in your fiscal year 2015 for the mission?

Mr. BOLDEN. Mr. Chairman, we requested in the 2014 budget \$105 million, which we are spending. We requested a slight increase in 2015. I would refer the committee to either screen here because I think it will help me explain the concept itself.

We have not changed anything in the concept development. You made the comment that we are already backing down on the con-

cept of retrieving a small asteroid. We have always been looking for the best options for carrying out this mission. We have had public forums; we have had three to date. We just recently had another forum at NASA Headquarters, where people from around the world came in and gave us their ideas on the best way to carry out this mission.

So we are in the formulation phase. It is very early in the development of any mission of this type.

As I have told people, we are going to assume a lot of risk with this mission. We are not going to do the standard NASA mission development that would cause it to cost a small fortune. We are looking at trying to keep the cost of the mission down. We are looking at utilization. We are looking at the development of technologies. Solar Electric Propulsion is primary. That is the number-one goal for our Space Technology Mission Directorate. They are singularly focused on that above all else.

So everything that we are doing is dedicated to finding the technologies that we need to conduct this mission so that when we have the SLS and Orion ready to carry a crew to lunar orbit that there will be an asteroid or a portion of an asteroid there for them to sync up with and carry out the types of proving-ground activities that we need if we are going to go on to Mars. It's really critical.

The other thing that we need and I have to go back to is, we need a low Earth orbit infrastructure from which to operate. The International Space Station is our toehold right now. The President recommended extension of Station to 2024, which is vital, absolutely vital. We are not requesting any additional funds over what we already have in our run-out from the 2014 budget in order to take Station to 2024. But it is good news to industry, it's good news to the science community, it's good news to our international partners.

But we have got to have an American capability to get our astronauts there. Otherwise, I am going to have to continue to pay the Russians for transport.

So my number-one objective in meeting with this panel today is to help everyone understand the critical importance of supporting the President's request, full request, for \$848 million for commercial crew, because that is an integral part of the low Earth orbit infrastructure, which is step one, our Earth-reliant step. If we don't have that infrastructure in place, everything else breaks down, in terms of deep space exploration. So I will keep coming back to that point.

Mr. WOLF. Okay.

I am going to go to Mr. Fattah, but I'll end this with: The asteroid mission does not seem to have captured imaginations among Congress or the American public.

I think, and I could be wrong, the authorizers to date—do you know what the authorizers did on this?

Mr. BOLDEN. Mr. Chairman, the authorizers are—

Mr. WOLF. Their draft bill would prohibit it. Go ahead, and then I can finish, or you can go.

Mr. BOLDEN. No, I would love to hear where they are today, because the last time I talked to them—I'm hoping I can find out where they are.

Mr. WOLF. Okay.

We have also not heard much from your international partners about their interest or lack thereof, but a National Research Council report, which the subcommittee requested, noted that the enthusiasm for the concept was low.

Have you received any indication of support or interest from your international partners? And have any such indications of support been formalized?

Mr. BOLDEN. Mr. Chairman, quite indeed, everything has been formalized. Subsequent to the NRC report that came out, 12 nations in the world, 12 space-faring nations, have signed a document called the Global Exploration Roadmap, in which they all agree with President Obama that sometime in the 2030s, is the time that humans should be trying to get to Mars, that along that road there must be a stepping-stone approach.

Those 12 signatories said that an asteroid redirect mission is an important part of that for technology development, that there is a need to go to the Moon, that there will be commercial interests, there may be international partner interest in getting back to the Moon. The U.S. never left the moon, by the way. We have been there from the days of Apollo, and we remain there today.

We had 31 nations of the world assemble at the State Department back at the beginning of this year for an international exploration summit. Thirty-one nations of the world sounds like some interest and enthusiasm to me. What was most impressive in the forum, that 2-day forum, was the number of nations who would not otherwise have had an opportunity to participate in exploration saying how excited they were about joining the United States and our other partner nations in pursuing such a bold goal as to get humans to Mars. They wanted to know, how do we get involved, how do we become a member of the team, how do we get involved with the asteroid redirect mission.

I mentioned the forum that we had last week. I would encourage all of you to Google “junior high school, Raleigh, North Carolina, asteroid,” and you will find the most incredible video about a team of seventh-grade students who, over the past year, have identified, using the data that NASA and other nations have made available, identified four new asteroids. I’d say that’s interest that we did not see before. So I’d disagree with anyone who says that there has been no interest generated in this mission.

Mr. WOLF. Mr. Fattah?

ADMINISTRATOR BOLDEN’S RECORD OF SERVICE

Mr. FATAH. Thank you, Mr. Chairman.

And thank you, Mr. Administrator, for your extraordinary service to our country.

Just for the record—and, obviously, you know of your great work, but I want to put this on the record for the Congress. Now, after graduating from the Naval Academy, you flew over 100 combat missions on behalf of our country?

Mr. BOLDEN. Yes, sir.

Mr. FATAH. And after you went into the astronaut program, you returned after your last shuttle mission to our Armed Forces; you went back into Active Duty with the Marine Corps as a deputy

commanding midshipman. And then you were the deputy commanding general in the First Marine Expeditionary Force in the Pacific in 1997, and you were the commanding general of the First Marine Expeditionary Force in support of Operation Desert Thunder in Kuwait. You were then promoted to your final rank as major general in 1998 and deputy commander, U.S. Forces in Japan. You have received a number of awards and acknowledgement for your military service, including the Distinguished Flying Cross.

And you, obviously, as leading NASA, you are still committed to protecting the United States of America.

Mr. BOLDEN. I am very much so. Sir, that's the reason I mentioned in my opening remarks, no one was more concerned than I when we discovered the vulnerabilities that we had in our foreign access program.

Mr. FATTAH. Well, I want to thank you for your bravery and for acting with courage on behalf of our country.

Mr. BOLDEN. Thank you very much.

THE VISION FOR SPACE EXPLORATION AND ITS IMPLICATIONS

Mr. FATTAH. Now I want to ask you some questions now about where we are.

Given the situation, you had in—2004, after the shuttle disaster, there was a commission set up by the Bush administration—and it conducted a review. The report that came out—let me just find it—said that you wanted to—that it was important to retire the shuttle.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. This is in 2004. This was a report about the vision for NASA going forward.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. And this report laid out a timeline that, in essence, created a 4-year gap—

Mr. BOLDEN. Yes, sir.

Mr. FATTAH [continuing]. In which the United States would not be able to take astronauts to the Space Station.

Mr. BOLDEN. That's correct, sir.

Mr. FATTAH. So when the public is thinking about where we are and why we have to pay upwards of \$50-plus million for the Russians to transport astronauts, this was a decision that was put in place by this report.

I want to put this title into the—The Vision for Space Exploration.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. And it was published in 2004. And it directed NASA to, quote, "retire the space shuttle as soon as the assembly of the International Space Station was completed."

Mr. BOLDEN. Yes, sir, and we did that. We—

Mr. FATTAH. And you did that.

Mr. BOLDEN [continuing]. Successfully retired the shuttle in 2011.

Mr. FATTAH. It was necessary to retire it—

Mr. BOLDEN. Yes, sir.

Mr. FATTAH [continuing]. Because of its putting the safety of our astronauts—

Mr. BOLDEN. I don't—we've talked about it.

Mr. FATTAH. I just want to put—

Mr. BOLDEN. I don't think it was an issue of safety. It was an issue of being able to explore. It was—

Mr. FATTAH. I got you.

Mr. BOLDEN. It was an issue of being able to explore, and we couldn't continue to operate the shuttle. We needed the infrastructure.

Mr. FATTAH. Okay. And some felt it was also that the fleet was at a point where it needed to be retired, right?

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. The point is that this gap exists and it was pre-determined.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. And now we have a new circumstance, because we had a situation in Ukraine.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. And so, when you come to us today and say you need \$840-plus million for commercial crew, commercial crew was a hard-fought issue because there were those who wanted to hold on to the old NASA.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. And then this administration, the Obama administration, was pushing this new effort, which was, let's commercialize lower Earth orbit. Let's take American ingenuity, American companies, and let them compete to transport cargo and crew to the Space Station.

And we have now, you successfully working with the private sector, have a number of companies that have competed, have gotten contracts with NASA and are going for it, in terms of delivering cargo. And now we want to move to crew, which is what this \$848 million is all about.

And so your request to us is important, not just because you want to continue the program, but in light of what's happening in the Ukraine, it's critically important. We have a space station we spent billions on. Right? We ought to be able to get—if we want biomedical experiments, which I do, in neuroscience and in other areas to continue and we want other science to take place there, we've got to be able to get back and forth. And we don't want to be in a situation where we don't have the capacity to do so.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. And the only way that is envisioned to do this—because there aren't any more space shuttles to do it.

Mr. BOLDEN. No, sir.

Mr. FATTAH. The only way to do this is through these private companies that have now been established.

I went and visited one of these companies, SpaceX, out in L.A., and they were building these rocket ships right there, with American ingenuity and suppliers; the supply chain is American. And there are other companies: Orbital Science; Sierra Nevada, a company that's, I guess, in your failsafe mission—

Mr. BOLDEN. Yes, sir.

Mr. FATTAH [continuing]. Position in this deal, right?

So I want you to talk to the committee about this \$840 million and how important it is, given where we are.

Mr. BOLDEN. Thank you very much, sir.

If we go back to 2004, it was a decision that I vehemently agreed with, as a shuttle person, because I came to NASA to explore, and I knew that, in order for us to explore, we could no longer continue to sustain a \$3-billion-a-year infrastructure to operate shuttles. So we knew we needed to have the low Earth orbit infrastructure and that at some point we needed to retire the shuttle.

Everyone accepted the fact that there would probably be about a 4- to 5-year gap. When I became the NASA Administrator, this committee, Senate committees, everybody said, look, we've got to cut the gap down. The President asked for a billion dollars. That was the estimate out of the Augustine Committee, that was the estimate out of industry, that was the NASA estimate, was roughly \$6 billion over the next 5 years to facilitate the success of a commercial space industry to carry crew to low Earth orbit. We said, if we don't get the funding, then the gap will extend.

When I became NASA Administrator, the goal was to have commercial crew available in 2015. We got zero the first year. The next year, the Congress did award us, I think it was \$525 million, and that allowed us to kind of eke out enough to keep the commercial companies going toward commercial cargo and crew. But the gap extended at one point, and we went to 2017. So we now find ourselves looking at that gap until 2017, which, if we don't get the funding we requested, we're going to slip again.

\$848 million is important for two reasons. One, it allows us to have a chance at having competition. Hopefully no one on this committee will argue that competition will not keep the price down. Competition is good because that's the American way of doing business. The second reason is because it allows us to have faith that we can get to the 2017 date, so it allows us to buy down risk.

I would like to have a billion dollars a year. That's what we said, \$6 billion over 5 years. We have found a way, working with industry, that we can eke it out by spending a little bit less than that, but that's not the way to operate.

Mr. FATAH. All right. Thank you very much.

And one other challenge around deep space or travel to Mars is technology.

Mr. BOLDEN. Yes, sir.

Mr. FATAH. And that's another part of this budget I'd like you to spend a minute on. Because we don't have the technology to send human beings to Mars now.

Mr. BOLDEN. There are things we don't yet know.

Mr. FATAH. Right.

Mr. BOLDEN. I think the committee should have a series of charts that we gave them. If you look at one of those—there are two matrices, and I think Mr. Culberson has one of them, one is labeled, what we get from the various missions. One looks like this. It's the "ISS and ARM Provides First Steps to Mars." This is a chart that lists technology developments that will come step by step, one, with the International Space Station mission, and it shows you what we are accomplishing from that, and then what we'll get from the as-

teroid redirect mission, what we'll get from the Mars orbiters that we have.

There is another set of charts that show you the medical hurdles to getting humans to deep space. It shows you how we're buying down risk bit by bit with every International Space Station increment, with a flight in our proving ground where we develop more robust environmental control and life support systems. That's the one that's called "Human Exploration and Operations, Human Research Program Integrated Path to Risk Reduction."

So we've had these matrices looking at risk reduction for a number of years. We continue to be asked, what's the roadmap, where are you going. This is a pretty detailed roadmap of how we're going to do exactly what you're talking about.

We have human risks that have to be retired. We have known this. This has been vetted by the National Research Council and other outside organizations away from NASA. We have had our Technology Development Roadmap that has been vetted by the National Research Council. That was done the first year that I was the NASA Administrator.

So we've been on this path since 2009. I can't help that people want to refuse to accept the fact that we are on a progressive, step-by-step path to get humans to Mars in the 2030s.

Technology development is critical. Solar Electric Propulsion we need. Optical communication, so that we can get voice and data back to Earth in much bigger bundles than we do today. Valuable also to the DOD and the intelligence community, because all of you have heard people talk about "the pipe." The U.S. has little pipes for getting pictures and imagery and everything back down to Earth from space, from airplanes and everything. We're trying to develop the technology to—

Mr. FATTAH. I note that a number of the companies have now started to be able to do business with the U.S. Space Command—

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. [continuing]. And General Shelton. So NASA is helping in that respect, too.

But I just want to close with this because we want to move on. I was on the Mission Control floor at the Jet Propulsion Laboratory at the moment in which the Mars Rover landed on Mars. And it, I think, captured the imagination of the entire world, that after 8 1/2 months of travel you were able to land this device on the surface of Mars.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. And it really puts us all in a position to know with certainty, even though we don't know how to do it yet, that you will be able to put someone there.

Mr. BOLDEN. Yes, sir. We can do that.

Mr. FATTAH. Thank you very much.

Mr. WOLF. Thank you, Mr. Fattah. I just want to correct the record.

I wasn't going to get into this, but I think you've misled people—

Mr. BOLDEN. Okay.

COMMERCIAL CREW PROGRAM

Mr. WOLF. The Congress has provided a lot of funding to commercial crew, particularly once you take into account the larger fiscal situation. There has never been a year that it received zero. One year it was 312; that was the authorized level. Then 406. 525 was actually above the level.

The appropriation has been at or above the authorized level in all the years but one—

Mr. BOLDEN. Mr. Chairman, our—

Mr. WOLF. Let me—

Mr. BOLDEN. Mr. Chairman, our numbers—

Mr. WOLF. Well, let—

Mr. BOLDEN. Yeah. Our numbers don't jibe.

Mr. WOLF. Okay. Well, then come up and sit down, and we'll go through it with you.

Mr. BOLDEN. Okay.

Mr. WOLF. Since taking over this subcommittee, we have appropriated almost \$2 billion for the program, including increases every fiscal year, while the subcommittee's top line has simultaneously been decreased by \$10 billion. We've protected this program. We have protected planetary. We have protected James Webb, when you were over the budget.

We provided commercial crew with support even though NASA could not provide us with the information needed to make the best decisions. For example, we waited for a year and a half for NASA to commit to a program acquisition strategy, which had enormous implications for the total program cost. Also, despite repeated requests, NASA always refused to tell the subcommittee the expected budget or schedule impact of different program funding totals. As a result, we were often required to make decisions in an information vacuum.

Even now, NASA is asking for more than \$800 million for the program and cannot tell us with any certainty how many commercial partners could be supported at that level or what year a final capability would be available.

And, frankly, I think there is enough blame on both parties. The administration bailed out on the Simpson-Bowles Commission. I mean, frankly, they had an opportunity to deal with this issue. Right now, you are finding entitlements are eating up funding for research on cancer, on autism, on all these programs.

And so I think the posturing is just beyond. So I am going to ask you to have your people come up—

Mr. BOLDEN. Yes.

Mr. WOLF [continuing]. Verify precisely what you said and what we said. And we will put it in the record at the end.

[Clerk's Note.—NASA and the Committee agreed to the following table displaying funding requested, authorized and appropriated for two Commercial Crew Programs for fiscal years 2009 through 2014:]

Expenditures for Commercial Crew Program							
	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	Total FY 2009-2014
Commercial Crew Program							
President's Budget Request	\$ -	\$ -	\$ 500.0	\$ 850.0	\$ 829.7	\$ 821.4	\$ 3,001.1
Authorization	\$ -	\$ -	\$ 312.0	\$ 500.0	\$ 500.0	\$ -	\$ -
Appropriated Budget	\$ 51.1	\$ 0.1	\$ 321.4	\$ 406.0	\$ 525.0	\$ 696.0	\$ 1,999.6
Operating Plan	\$ 51.1	\$ 0.1	\$ 321.4	\$ 397.0	\$ 525.0	\$ 696.0	\$ 1,990.6

Notes

1. FY 2009 - FY 2013 reflect the final Operating Plans for those FY; FY 2014 reflects the Initial Operating Plan (IOP)
2. FY 2009 Operating Plan amount reflects the April 2009 IOP to Congress which re-allocated Recovery Act (ARRA) dollars to Commercial Crew
3. FY 2012-2014 Appropriated Budget reflects appropriations provided specifically for Commercial Crew. In FY 2009-2011, Commercial Crew was not separately identified, but was part of a total value provided for Exploration
4. FY 2012 Operating Plan amount reflects NASA's request to re-allocate \$9M of funding to the Commercial Orbital Transportation (CoTS) program
5. FY 2013 Appropriation amount reflects pre-rescission and pre-sequestration reductions

Mr. WOLF. But, you know, there are other programs, too.

Mr. BOLDEN. Yes, sir. Mr. Chairman, I—

Mr. WOLF. James Webb is important.

Mr. BOLDEN. As I said in my opening—

Mr. WOLF. Planetary is important.

Mr. BOLDEN [continuing]. Statement, I appreciate all the support that this committee has given us. Mr. Chairman, I have not argued—this committee has given us incredible support in the appropriations. I made that statement in my opening remarks.

But when I say our numbers are different, I'm not sure where the staff is getting their numbers from, but I've got the budget run-out—

Mr. WOLF [continuing]. Pretty good staff, but—

Mr. BOLDEN. Well, I—

Mr. WOLF. Let me go to Mr. Harris, and we'll have your people—

Mr. BOLDEN. Okay.

Mr. WOLF. You come up, and we'll sit down.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. I'll be at the meeting, too.

Mr. BOLDEN. But, Mr. Chairman—

Mr. WOLF. Sure.

Mr. BOLDEN. The Congress has given, has provided about \$2 billion for commercial crew. We have requested \$3 billion over that period of time. So I'm not sure where—

Mr. WOLF. But, Mr. Administrator—

Mr. BOLDEN [continuing]. The staff says that you have given us more than we asked. That is not—that's just inaccurate. We have asked for \$109 billion from fiscal year 2010 to 2015 for NASA. \$52 billion of that has been for Human Exploration and Operations. Through fiscal year 2014, we requested \$91.837 billion from Congress. Congress appropriated \$89.454 billion. That's \$2.3 billion less than requested. So I will be glad to have my folks get together with the committee, but I want to make sure, because this is—every time I come here, my integrity is impugned, you know.

Mr. WOLF. No one is impugning your integrity.

Mr. BOLDEN. Mr. Chairman, you may say that, but when you say I have misled the committee, when you say I'm giving incorrect numbers—I am going to have my team sit with your committee, and we are going to resolve where the difference is. Because I do not believe they can show me where any committee of the Congress has appropriated more money than the President asked for commercial crew. That is just not true.

Mr. WOLF. There is—

Mr. BOLDEN. We have spent \$12.5 billion since I've been the NASA Administrator on SLS and Orion. SLS and Orion are on target right now for the projected launch date that we've said. We're going through a key decision point process right now on SLS and Orion. So when they say I haven't given you something on commercial crew, I haven't done that with SLS and Orion yet. We haven't reached the point where we have said, we commit to this amount of money for SLS and Orion and we commit to this launch date.

The process that NASA and every other government agency follows, there is a point at which we make a promise to the Congress.

We did that, as you said, with the James Webb Space Telescope. We promised you a 2018 launch for an 8-point-some-odd-billion-dollar budget. We are on target, on costs. We are a year ahead on schedule.

So, now, when the staff says—we are going to get to the bottom of this. Because I am tired of having my integrity impugned by members of the committee and the staff.

Mr. WOLF. Well——

Mr. BOLDEN. I am just not—I am offended.

JAMES WEBB SPACE TELESCOPE

Mr. WOLF. What was the original estimation for James Webb?

Mr. BOLDEN. The original estimation for James Webb, made by many predecessors of mine, I think it was \$800 million.

Mr. WOLF. And it was first priced out at around \$400 million——

Mr. BOLDEN. And let me tell you, as I said to Senator Mikulski——

Mr. WOLF. What will the cost be in final?

Mr. BOLDEN. What were the costs being funded for James Webb?

Mr. WOLF. Yes.

Mr. BOLDEN. I think we have always gotten what we asked for James Webb.

Mr. WOLF. What will the final cost be for James Webb?

Mr. BOLDEN. Oh. It's \$8.5 billion, I think. I'll take it for the record to give you the precise amount.

[The information follows:]

JAMES WEBB SPACE TELESCOPE (JWST)

NASA's commitment is to complete formulation and development (phases A–D) of JWST for \$8.0B, and to complete the entire mission (including five years of operations and data analysis) for \$8.828B.

Mr. BOLDEN. And that cost estimate came out when I came before the Congress and said, no one is as embarrassed or ashamed as I am that James Webb has gotten this much out of control.

We talk about accountability. We made changes in the management at the Goddard Space Flight Center, at headquarters. We worked with our prime contractor; they made changes in their management structure. We reformulated our spending plan, and we brought that back to the Congress, and we got blessing from the Congress. We're on our spending curve right now. We are 13 months ahead in terms of the critical timeline.

So, Mr. Chairman, I think we're in sync. You just got me angry when you—you did not impugn my integrity, but I keep getting these notes sent up that says, he's not telling you the truth. I am telling you the truth. So, I mean, if somebody's going to call me a liar and say I'm misrepresenting to this committee, I take that personally. I'm not going to take that.

Mr. WOLF. Mr. Administrator, no one called you a liar.

Mr. Harris?

LOX/HYDROCARBON ENGINE

Mr. HARRIS. Thank you very much.

Thank you, General. And it's always a pleasure to have an Academy graduate here. My daughter got her appointment last month,

and should she go there, she would leave, I guess, on the 50th year after your graduation from the Academy.

Let me just follow up on a—or, actually, bring up a different topic, I think. In that new appropriation to get our—you know, in response to what is happening with our relationship with Russia, is there research moneys to develop, you know, large liquid engines?

You know, unfortunately, you know—and it is not just getting our crew up to the Space Station. You know, we have a gap if things deteriorate and we don't have these large liquid engines. So how do we—how fast can we make our own?

Mr. BOLDEN. Dr. Harris, you know, there is an ongoing study between NASA and DOD. We have an engine study that's under way, and I think it may actually have already reported out and gone to the Secretary of the Air Force, and I will see it soon.

I will take it for the record to give you the timeline on giving the U.S. what we call LOX/RP.

[The information follows:]

AVAILABILITY OF RUSSIAN ROCKET ENGINES

The Administration is involved in a broader ongoing discussion regarding Russian rocket engines that involves the national security and commercial communities. Should Russian-built RD-180 engines no longer be available for use by the United States (either through action by the U.S. government or the Russian government), RD-180 engines currently in inventory within the United States could still be used to fly near-term Atlas V missions. In addition, the U.S. has another rocket available that uses an American rocket engine—the Delta IV launch vehicle is powered by the U.S.-built RS-68A liquid oxygen/liquid hydrogen rocket engine, which is the world's highest thrust liquid hydrogen engine producing over 700,000 pounds of thrust. Currently NASA does not have funding identified in its budget for the development of a U.S.-built, RD-180-class, liquid oxygen/kerosene rocket engine.

Mr. BOLDEN. It's the system we used to use in the Apollo program. And then we went to LOX hydrogen for shuttle. And we're trying to bring that capability back to the Nation, because right now the people who are the experts in it are not American, and so we need to catch up. So we recognize that as an important challenge. That is one of our technology development efforts that Congressman Fattah referenced earlier. So we're working on that.

Mr. HARRIS. If we lose access to those large liquid engines from the Russians, what gap would that create in our ability in space?

Mr. BOLDEN. Dr. Harris, I don't want to deal in supposition. We have an incredible partnership with Roscosmos. I have to use the term "Roscosmos" because that's the Russian space agency, and Energia and the other companies with whom Boeing and Lockheed Martin—our industry partners deal with them on a one-on-one basis, and those partnerships are solid. The difficulty between our nations is a different issue.

What we have managed to do with the International Space Station for 15 years now, through the intervention in Georgia, through what's going on right now in Crimea and Ukraine, the people who are really focused on the mission are really dedicated to just keeping our heads down and staying focused on that mission.

I don't want to engage in suppositions. We all have plans in place right now that we think we're going to be okay. If you look at DOD and their suppliers, they have X number of years' worth of engines that are in stock. Same thing with Orbital Sciences, my commercial

provider, that uses the AJ-26, which it's owned, wholly owned, by Americans now, so we're not dependent on the Russians or anybody else. But there is a limited number of those. So you're absolutely right; what we'd like to be able to do is produce those here in the U.S.

Mr. Chairman, I apologize for losing my temper. I get hot sometimes. I think I misunderstood you. I think what you were addressing—I apologize, Dr. Harris. But I think what you were addressing was the fact that appropriations exceeded authorizations. So if that's what you said, I apologize, and I did not mean that. So, hopefully, you will forgive me and let me bring my granddaughters out to fish.

NASA AND ROSCOSMOS RELATIONS

Mr. HARRIS. No, so—no, I appreciate that, but, you know, this is different from Georgia. I mean, we are talking about economic sanctions. You know what happened this weekend; you read the same newspapers I do. You know, there is a chance that this all gets geared up and that, you know, relationships that transcended politics in the past may not transcend them.

So, I mean, is—and I would imagine this is true. I mean, I would imagine that there is a contingency plan being drawn up very actively in terms of what if those relationships break down.

Mr. BOLDEN. Dr. Harris, there are always contingency plans, but the contingency for what you're addressing is maintaining the relationship.

When I call Mr. Ostapenko, who is my counterpart with Roscosmos, as I did last week when the headlines in The Moscow Times, or whatever their newspaper is, was totally erroneous—the headlines in Moscow was “NASA breaks off all relations with Roscosmos.” Nothing could've been farther than the truth, but that's the alarmist nature of our media today. So, when Mr. Ostapenko and I talked, he was very comforted to know that, okay, our relationship had not been broken, had not changed.

That is a contingency plan. I know most people don't accept that, but in the military, where I come from, your contingency is engagement, and it's making sure that your adversary knows how far you will go.

I think the Russians are quite aware of several things: one, that the International Space Station doesn't belong to us, doesn't belong to them. It is a conglomerate of five partners.

The two big experiment modules, one belongs to the Europeans, the other one belongs to the Japanese. They are clamoring to be allowed to work in those modules, because right now the Russian cosmonauts don't work in the other modules. They want to become a more active member of the team. The Russians provided two things: access, that's transportation; and the big power. When it comes to operating day by day, environmental control, those types of things, that's what the U.S. provides.

So the contingency is, if they want to continue to operate in lower Earth orbit, they've got to stay in the partnership. They know that as much as we do.

Mr. HARRIS. Well, thank you very much, General. Because, as you know, I mean, my district is right next to Wallops.

Mr. BOLDEN. Yes, sir, I—

Mr. HARRIS. And you know how important the Space Station is for Wallops. So I appreciate that.

And I yield back, Mr. Chairman. Thank you.

Mr. WOLF. Thank you, Mr. Harris.

Mr. Schiff.

MARS PROGRAM

Mr. SCHIFF. Thank you, Mr. Chairman.

Mr. Administrator, welcome. It's good to see you again back in the subcommittee.

And I also want to acknowledge former Attorney General Thornburgh. It's great to have you here. I want to thank you. When I was an assistant U.S. attorney back in the early 1990s, you sent me to Eastern Europe for half a year, and it was a roundtrip ticket, so I am grateful. It was a fantastic experience, consulting with the Czechs and Slovaks on criminal justice reform. It was a great assignment.

Mr. Administrator, while I appreciate the somewhat better request for planetary science in this year's budget, I still remain concerned that it won't be sufficient to meet the Nation's goals in exploring our planetary neighbors.

NASA's planetary science program has been one of the most successful and spectacular scientific endeavors in human history. From the earliest Mariner series probes in the 1960s to Curiosity on Mars, our planetary program has captured the imagination of the world. And last week's revelations about liquid water on Enceladus has added another destination for our robotic emissaries to explore.

I want to just flag—and I am going to let Mr. Culberson handle the majority of the comments on Europa, but I only want to express my full support for what he is undoubtedly going to say. I am a full supporter of Europa. And while I am pleased that it is in the budget, I am concerned that it is at such a small number it won't let us get that mission really started in the way I think it should.

But I will leave it to John to focus more on that. Let me focus more on Mars sample return, the science community's top priority.

NASA has a proposed mission to be launched in 2020. I am concerned about the funding profile for this mission, which is backloaded, as well as repeatedly disquieting rumors that I have heard regarding slipping the launch date to 2022. Given the position of the planets, 2020 is a particularly advantageous launch opportunity that will enable us to launch a heavier payload to Mars. More payload means more science. 2022, on the other hand, is supposed to be a suboptimal launch window.

So if you could tell us the status of the 2020 Rover now and what we need to do to ensure that it goes in 2020.

And then, second, I wanted to ask you about the extended missions generally and Opportunity and LRO in particular.

As a threshold matter, I oppose turning off healthy spacecraft that are delivering good science, and I know you do as well. Opportunity has been delivering incredible science from the Martian surface for more than a decade and costs about \$13 million a year to

operate—relatively little when you consider the hundreds of millions that we spent to get it there.

Leaving the Rover to die a lonely, cold death when it's fully functional would be a terrible loss of good science and, I think, speaks volumes about the overall need for greater resources for our planetary science program.

And I am not at all comfortable with the idea of putting the funding for this extended mission in a new government-wide fund which, even if it gets funded—and that is a very big “if”—would only protect these missions for another year. I think they really belong in the baseline budget.

So if you could comment both on the Mars 2020—

Mr. BOLDEN. Yes.

Mr. SCHIFF [continuing]. And those ongoing missions.

Mr. BOLDEN. Doctor.—Mr. Schiff, the—

Mr. SCHIFF. You can call me “Doctor.” It was always my parents’ hope, and—

Mr. BOLDEN. I—that’s okay. I probably could. You’re a pretty smart guy.

Hopefully everyone will tell you that the 2015 budget does support Mars 2020 in 2020. It does several things for Mars exploration.

It supports the 2020 mission, which is sort of a Curiosity—I hate to say a clone, because we’re trying to decide now whether it will be a complete clone or what. The science definition team is off doing their work, trying to decide what’s going to be in it from a scientific perspective, what objectives.

One of the biggest things for the science community is the fact that it will have a caching capability. So it will cache or put in storage soil samples that will subsequently be returned to Earth at a time that we hopefully will be able to identify while I’m still the NASA Administrator.

In addition, it funds the 2016 launch of InSight, which is a critical mission to Mars, also, that will allow us to core into the Martian subsurface.

I will say that you and I agree, sort of, on extended missions. I think extended missions are great until they start to jeopardize the ability to fly new missions and to generate the kind of excitement and interest in young people in colleges and universities who will want to come in and become engaged in the development of a new mission. So it’s a delicate balance as to how long do you fly extended missions.

The totality of our extended missions today is keeping us from being able to do some of the exciting things that we would really like to do. So what we have to determine is, okay, what is the right time to turn off an extended mission. Every mission we fly, we can continue to get data until the cows come home, as they say. But at what point do you say, we have enough data in the repository and now we’re going to analyze some of that data while a new team goes off and develops a new mission.

So I said all that to say we’re continually evaluating our extended missions. The Science Mission Directorate has a senior review panel that’s in session right now, and they will decide the fate of some of the extended missions. It may be determined that, okay,

it's time to turn off the lights, and others most certainly will be continued. Cassini, we already decided we were going to continue.

As a side light, you mentioned Enceladus; I didn't. But Enceladus is a very attractive icy moon that some scientists believe holds more promise for life than Europa. So I did not need another challenge to Europa—

Mr. SCHIFF. You're just going to get John started.

Mr. BOLDEN. I know, I know. But I'm just saying, you know, that this is the input that we get.

Governor Thornburgh mentioned it before, about trying to change cultures. One of the cultures that I'm trying to change is people coming to Members, instead of me, to complain about the amount of money they get, knowing that there is only a limited amount of money. And they get people, you know, excited about their project, but it doesn't fit the total portfolio—what we feel is a balanced portfolio of the agency.

But I think we're doing relatively well considering the fiscal constraints in planetary science.

Mr. SCHIFF. Well, Mr. Administrator, I appreciate that. You know, we have the nice problem that these craft are built so well that a Rover that had a 90-day—

Mr. BOLDEN. Yeah.

Mr. SCHIFF [continuing]. Planned life is now going strong 10 years later.

Mr. BOLDEN. Yes, sir.

Mr. SCHIFF. But if, as I believe, they are producing good science, I think we would be crazy not to continue their operation, and we will have to find the resources to do it.

COOPERATION WITH INDIA ON SYNTHETIC APERTURE RADAR

One last question. I am delighted that letters of interest have been exchanged between NASA and the Indian Space Research Organization on NASA, ISRO, synthetic aperture radar mission. This collaboration between the two countries is critical to the interests of both governments and represents a true partnership in the Earth system sciences that will benefit all.

Given the importance of the mission around the globe and, in particular, to California and many Western States in enabling critical understanding of natural disasters like earthquakes and managing water resources, what would be required to move to a launch date of 2019?

Mr. BOLDEN. We don't have a launch date for the mission you're talking about yet. It's not a defined mission. We're still in negotiations with the Indians to see whether they think they can provide the instruments and the like. So it is a mission in formulation.

I'll take it for the record to find out whether 2019 is a date that we think is feasible or whatever.

[The information follows:]

INDIAN SPACE RESEARCH ORGANIZATION (ISRO)

During Formulation (Phase-A and -B), NASA and ISRO are finalizing the workshare and schedule agreements for the NI-SAR mission. With regard to spaceborne hardware, ISRO presently plans to provide the spacecraft, the S-Band SAR science payload to be integrated with the NASA-supplied L-Band SAR instrument and reflector, the GSLV Mark-II launch vehicle and launch services, and mission

operations. Determining a detailed baseline schedule will only be possible once both NASA and ISRO come to technical and programmatic agreement in several areas and once the two agencies coordinate their individual domestic approval processes. Assessing the feasibility of any acceleration is not feasible until NASA and ISRO complete the workshare and schedule agreements during Formulation. As documented at the NI-SAR KDP-A review at NASA in March 2014, from a purely U.S.-perspective, a 2019 launch date is not feasible within the current funding environment; both NASA and ISRO are working to determine the feasibility of a late CY 2020-2021 target launch date for NI-SAR.

Mr. BOLDEN. This is, however, one of these new missions, that we'd really, really, really like to fly, but it is in the classification of the Earth science missions that many members of the committee would like to see us take more money from. So this is a pull and take, push and tug. I can't take money out of Earth science and fly the Indian Space Research Organization (ISRO) mission, if anything, it would be nice to plus-up the Earth science budget in order to be able to do that. That is one of the considerations in the launch date if we decide we're going to fly that mission. I am hopeful that we will because of what it will do for us in terms of geodetics and other things that we don't have the capability to do right now.

So I share your enthusiasm about the prospects of the mission and the potential for it, but finding funding for it in the Earth Science Division, whose budget is always strained, in spite of what some people think—because every natural disaster, Mike Freilich and the Earth Science Division put instruments on an aircraft or redirect a satellite to respond to that natural disaster, and none of that is budgeted. So he has to figure out a way to take money from the Earth Science budget to respond to natural disasters, and they do it absolutely incredibly well.

So, we'll find a way. As long as we can get the Indians to come and make sure that they're going to be a reliable partner in this, then I think we'll develop a mission.

Mr. SCHIFF. Thank you, Mr. Chairman. I yield back.

Mr. WOLF. Mr. Culberson?

EUROPA MISSION

Mr. CULBERSON. Thank you, Mr. Chairman.

General Bolden, thank you for your service to the country.

And it is an extraordinary privilege for me to be here on this subcommittee and to do everything that I can to help NASA achieve the extraordinary mission that you have set out for the country, really for the world. You're the only agency, I think, in the Federal Government, other than our men and women in uniform, who can really inspire and uplift young people. And it's really a privilege to be able to help you, sir.

As to the mission to Europa, you know, the Congress has supported that mission and has statutorily made sure that's going to happen because of the extraordinary importance of that moon. My good friend, Mr. Schiff, and I are on exactly the same page when it comes to our support for the planetary program. Chairman Wolf has been extraordinarily generous. This subcommittee, as you know, has been very generous in supporting the planetary program and in appropriating more money than was asked for by the President in his budget request.

And the Europa mission, in particular, is of extraordinary importance, I think even more so than Enceladus. Because the ocean that has been discovered at the southern pole of Enceladus is fairly shallow, is related really to the tidal flexing, and doesn't have all the other characteristics that you see on Europa.

Mr. BOLDEN. I knew I should've never mentioned that.

Mr. CULBERSON. That is basically a shallow lens ocean at the southern hemisphere of Enceladus, whereas the European ocean is worldwide and contains three to four times the volume of water on Earth.

Mr. BOLDEN. Yes, sir.

Mr. CULBERSON. You've got vast amounts—you've got a rocky bottom to the ocean in Europa, which is approximately 100 kilometers deep, that is equivalent to the depth of the Marianas Trench. So we have already done that. We have already demonstrated repeatedly since the 1960s that humans can reach the Marianas Trench with either manned vehicles or robotic vehicles and explore them.

You have undoubtedly also got huge volcanoes on the bottom of the ocean of Europa that are generating, because of the tidal flexing by the planet, by Jupiter. And it is also important to remember that the surface is less than—is probably approximately 60 million years old. And that saltwater ocean on Europa, that means that surface has been, you know, recirculating all this time.

And because of the high-radiation environment in which Europa sits in orbit around Jupiter, that radiation has stripped away hydrogen, so oxygen-enriched ice has been replenishing or oxygenating that ocean for billions of years. And, of course, you've got organic compounds. You've got all the elements for life on Europa.

And this is why the scientific community—it's not just the Congress, it's the—the Decadal Survey last decade and this decade put Europa at the top of the list. And we are delighted to see the line item in the President's budget and glad to see it, but of course the Congress is the one that has the final word on these things.

And it is important, I think, for NASA to remember also, and for all of us to remember, that the budget recommendation submitted by the President is just a recommendation. It is, you know, what the President would like to see done, but it is actually the Appropriations Committee and the Congress that sets the final guidelines.

CONSTELLATION AND THE IMPLICATIONS OF PROGRAM CANCELLATION

And, if I could, sir, I also wanted to make, if I could, make sure to clarify for the record that the President's budget proposal for fiscal year 2011 cancelled the Constellation program that President Bush had put in place.

Mr. BOLDEN. That's right.

Mr. CULBERSON. And about \$9 billion had been spent by that point in the development of the Constellation.

Mr. BOLDEN. Yes, sir.

Mr. CULBERSON. And that was squandered.

Mr. BOLDEN. No, sir.

Mr. CULBERSON. We still got some benefit obviously because that technology continued—

Mr. BOLDEN. Yes, sir.

Mr. CULBERSON [continuing]. To be used in the development of the SLS, but what's particularly distressing is that the—but for that cancellation, the Constellation would be operational this year.

Mr. BOLDEN. That is not correct, sir.

Mr. CULBERSON. What year would it be operational?

Mr. BOLDEN. We don't know, we don't know.

Mr. CULBERSON. If we had continued—

Mr. BOLDEN. You're asking for conjecture, Congressman Culber-
son. Constellation was not on a good trajectory, and we—this is something we would really, I would take for the record because we need to go back, and I don't want to state where Constellation would have been today, but Constellation was not on a good trajectory. We were talking about going to the moon. We had no plans, we had abandoned plans for the lander because of its cost. It was not a program on a good trajectory, and—but it was not money lost. Whatever was spent on Constellation was money well spent because we have taken advantage of the technologies that were developed there. If you look at the heritage of SLS and Orion, they come from the Constellation program—

Mr. CULBERSON. But—

Mr. BOLDEN [continuing]. So I would be the first to say that money was not squandered, was not lost.

Mr. CULBERSON. I would agree with you, but there's still some benefit obviously from that investment in the technology, but that but for the cancellation of the Constellation program, we would be very near the—

Mr. BOLDEN. All I can say is I don't know. I will take it for the record. I respect whatever analysis it is that you're using as the basis for that statement.

[The information follows:]

CONSTELLATION FUNDING

No. The Agency would not have been able to adequately fund the Constellation family of vehicles. In addition, the use of Orion, a spacecraft primarily designed for deep-space exploration, for LEO operations would be an inefficient use of a robust system intended for other purposes. Affordability and sustainability are key considerations of the Space Launch System (SLS) and Orion efforts—these programs reflect NASA's intent to develop vehicles with reduced operating cost, as evidenced by key design trades conducted that weigh potential production and operations costs against similar historical applications as key considerations. NASA's human spaceflight efforts are complementary, and will allow the Agency to procure U.S. commercial crew transportation services to LEO by the end of 2017, while focusing on the development of exploration vehicles that will enable missions to a variety of deep-space destinations, beginning with the first crewed flight of SLS/Orion in FY 2021–22.

Mr. CULBERSON. The projections that were done at the time by the NASA administrators that had created this program.

Mr. BOLDEN. When I became the NASA administrator, that was not the projection that I presented to anyone.

Mr. CULBERSON. Well, all—

Mr. BOLDEN. One of the reasons I—I'm just saying I'll take it for the record.

Mr. CULBERSON. All the projections that we're, that we have seen were that we would launch by 2015.

Mr. BOLDEN. Yes. I am saying, Congressman, I'm accepting your analysis, your assessment, but you asked me, would we be launched by now. I said I don't think so.

Mr. CULBERSON. Oh, by 2015.

Mr. BOLDEN. I don't think we would launch by 2015, but I don't have anything on which to base that. I did not do the thorough analysis that you have access to, but I will take it for the record, and we'll go back and if you would like, we will go back and we will try to project out where we think Constellation would have been today on the trajectory that it was when I became the NASA administrator. That's all I can do.

Mr. CULBERSON. Yes, sir, I understand.

Mr. BOLDEN. Yes.

Mr. CULBERSON. I just want to make it clear for the record, though, that but for the cancellation of the Constellation program, we would be very close to returning to low earth orbit.

Mr. BOLDEN. That is a subjective opinion—

Mr. CULBERSON. It's based on—

Mr. BOLDEN. And I'm just saying I don't disagree with your opinion, I'm saying I can't substantiate your opinion.

Mr. CULBERSON. I understand.

Mr. BOLDEN. Because I don't know.

Mr. CULBERSON. You've got an obligation, I understand, the Obama administration—

Mr. FATAH. If the gentleman would yield. I agree with you.

Mr. BOLDEN. No, no, Congressman, I don't have an obligation.

Mr. FATAH. I think we can find agreement that the United States of America and NASA has successfully put a man on the moon and brought him home, and we could probably have done it again, right? And that we were able to have low earth orbit travel to the space station on a regular basis, and that what the administration decided was that we wanted to explore where no person had explored before. That we wanted to have deep penetration of space and to seek human travel to Mars and that going back to where our Nation had already been decades earlier, or making routine flights to the space station was not something that required a governmental investment. That what we needed to do was get private enterprise in America engaged in this activity—

Mr. CULBERSON. Sure, I understand.

Mr. FATAH [continuing]. Of doing what the government had already done.

PROGRAM CANCELLATIONS

Mr. CULBERSON. Right, and I understand and agree with the policy. I have been a big believer in the Yellow Pages test for years. If you can find a service in the Yellow Pages the government does, you should do your best to try to privatize it. I think it's a wonderful thing that ultimately maybe we'll reach the point where, Mr. Fattah, I agree with you, that maybe you can step out, you can fly the low earth orbit, just like stepping out the front door of the Rayburn Building and catching a cab, it's a wonderful thing. But it's important because I didn't hear in the discussion earlier when you

were talking about the need to get back into low earth orbit and the focus on commercial, that it's critical that we remember that one of the first things the Obama administration did when they came in was cancel the Constellation program—

Mr. BOLDEN. Yes, sir.

Mr. CULBERSON [continuing]. In which \$9 billion had been spent, and it's just tragic because my good friend, Mike Coats, who was until recently the director of the Johnson Space Center, pointed out to me that one of the things—

Mr. BOLDEN. Twenty-five major projects.

Mr. CULBERSON. Unbelievable. I know I have shown this.

Mr. BOLDEN. That's a combination of Congress, administration, we all agree on that.

Mr. CULBERSON. It just breaks my heart.

Mr. BOLDEN. That is not a good story for the United States of America—

Mr. CULBERSON. It is horrible.

Mr. BOLDEN [continuing]. That between the Congress and multiple administrations—

Mr. CULBERSON. Yeah.

Mr. BOLDEN [continuing]. We can't follow through on anything.

Mr. CULBERSON. All these that are—

Mr. BOLDEN. I agree with you.

Mr. CULBERSON. All these programs in red were cancelled. Twenty-five cancellations over 20 years, it's just heartbreaking.

Mr. BOLDEN. But, Mr. Culberston, the only thing I ask in fairness is that you not attribute all those cancellations to the Obama administration.

Mr. CULBERSON. No, no, no, no, I'm not—I didn't say that. This is over, this is over 20 years.

Mr. BOLDEN. I know that. I just wanted to make sure I didn't—

Mr. CULBERSON. I never said that.

Mr. BOLDEN. There are some people who will assume because they always do that you're saying I am responsible for the cancellation of those 25. I wasn't even here—

Mr. CULBERSON. I never said that.

Mr. BOLDEN [continuing]. When most of them were done. I take credit for the, if you want to call it the reformulation of an exploration program focused on Mars instead of on the moon, and I take credit, I am very proud of that. As Congressman Fattah said, my admonition to the President and what I have always espoused is that that should be our destination, Mars, and not—the moon is an intermediate stop, and we are going back to the moon. We use that as a proving ground, and I have taken it as an action to demonstrate to the Congress why the technology required to go back to the moon does not, is not sufficient to get us to Mars, and so if you want to get somewhere, you have to set a goal that's just outside your reach. We tell kids that all the time. To get to the moon is not even out here. We can do that. We know how to do that. We have demonstrated that ability. We don't know how to get to Mars. So that's the challenge that I'm issuing to America's youth.

Mr. CULBERSON. The Congress and the administration, no matter who is in the White House, need to do everything we can to provide

stability and predictability to these programs so that they're not cancelled so that people who have devoted their whole lives, scientists, astronauts, engineers to achieving their life dream will be able to build a rocket—

Mr. BOLDEN. And Congressman Culberson, to be quite honest—

Mr. CULBERSON. Aircraft, it just breaks my heart.

Mr. BOLDEN. That's the reason that I have emphasized the critical need for us to collaborate rather than fight about funding for SLS and Orion. We have what we think is a sustainable program—

Mr. CULBERSON. Okay.

Mr. BOLDEN [continuing]. To develop an exploration program that will allow us to develop an SLS incrementally that as we need it. 70 metric ton now, 105 metric ton maybe, but at some point, we're going to need a 130 metric ton vehicle. I don't need to come to the chairman and ask him for funds for a 130 metric ton vehicle when I don't need it until the 2030s, and I want to have an opportunity to take advantage of technologies that will be developed between now and when I do need it so that we won't have a 2011, 2014 vehicle when we can have a 2020, 2025 model. It's like a car.

Mr. CULBERSON. Well, to give you greater stability, the Congress in the appropriations bill for 2014 included language that's something that we've all known but we put it in statute and made it clear that the, that no agency of the Federal Government nor officer of the Federal Government can change or reduce funding levels for any program or policy based on the President's budget. They can only do so based on the appropriations bill per the law.

Mr. BOLDEN. Yes, sir.

Mr. CULBERSON. That's statute.

Mr. BOLDEN. I am in agreement with you 1,000 percent.

Mr. CULBERSON. We have heard you. You've got no better friends in Congress than on this subcommittee. We're devoted to you and have done everything we can to support you. Chairman Wolf has been extraordinarily generous, as has the subcommittee, Mr. Fattah has helped. We have worked arm in arm to do everything we can to give you the support you need, and we're very proud of NASA's mission and we'll do everything—

Mr. BOLDEN. Thanks.

Mr. CULBERSON. We'll continue to do all that we can to help you, sir.

Mr. WOLF. Mr. Aderholt.

BALANCE AMONG HUMAN SPACEFLIGHT PROGRAMS

Mr. ADERHOLT. Thank you. Thank you for being here this morning. Sorry I came in late. I was chairing another subcommittee, where, as you know, Chairman Rogers has packed all of these hearings in so we can get to work in regular order, and which is a great thing, and so we're working diligently on all these hearings. Sometimes they just overlap.

So let me ask a little bit about, go back to SLS. My understanding is that in January you were pleased that Congress had funded the SLS rocket development work at \$1.6 billion, in the sense that those funds were necessary to keep the program going.

There is some concern that OMB and OSTP may be out of step with most Americans about the fact that Americans want the United States to lead the world in human exploration of space beyond low earth orbit.

For the 4th year in a row, we have a budget request that is below the combined total authorized levels of rocket development, ground operations, and SLS-related construction. The fiscal year 2015 budget request puts us at \$219 million below the funding provided in fiscal year 2014 appropriation bill on rocket development alone. If you stand back and you take a look, if SLS is not ready by calendar year 2017, it will be because of underfunded requests. In some ways, it is remarkable that the program has met its milestones so far despite a flat budget plan that has little connection with the engineering realities. NASA's recent description of the first SLS flight as being in fiscal year 2018 is an answer which is actually only three-fourths—is actually three-fourths unacceptable. The bill which I, along with so many of my colleagues, agreed to vote for and did vote for and which the President signed said 2017. Our goal is to work with the chairman to get the proper funding in place in this bill for fiscal year 2015. In this overall budget account of exploration, again, this year you asked for funding and commercial crew that is far above the authorized amount.

My question, would it make more sense if you take the committee's recommendation to down-select to one commercial crew provider, and meanwhile, to fund Orion and the SLS closer to their authorized amounts in order to ensure that they can meet their authorized role for being the backup for crew transportation to ISS, International Space Station, in 2017?

Mr. BOLDEN. No, sir.

Mr. ADERHOLT. Would it stabilize or even accelerate the three programs overall?

Mr. BOLDEN. No, sir.

Mr. ADERHOLT. Can you talk a little bit about that?

Mr. BOLDEN. If I don't get the President's request for commercial crew, whether I down-select to one or not, I can't guarantee that we'll make 2017, and we will have no U.S. capability to get our crews to the International Space Station in 2017, as we have all set as a goal. I could put all the money in the world into SLS today, and I could have an SLS available in 2015. SLS can't take a crew anywhere. SLS is a launch vehicle. We have to start as I said before, we've got to start talking to each other and understanding why you pay me to do what you pay me to do.

My advice to this committee and all committees has been, allow me the flexibility to spend as necessary such that SLS and Orion get to the finish line together. You know, if I finish SLS in 2013, if I had finished SLS in 2013, I would have parked it in a barn somewhere because I have no launch vehicle, I have no crew vehicle to put on it. My concern right now is making sure that Orion is going to be able to meet the schedule on which SLS is marching. We're closer to having KDPC, which is our decision point, our key decision point for SLS will be made here in the next month or so. That will tell us how the launch vehicle fares, and I'm comfortable with where it is.

I've got to now work intently to get to that same decision point with Orion, and Orion is a little bit more complicated than SLS because SLS wasn't impacted by the shutdown, for example. We lost a whole month almost in the shutdown on Orion because we had to lock the Lockheed Martin crews out of the Operations and Checkout (O&C) building, and that's time we'll never get back. So my concern is making sure that we continue to look at the integrated exploration picture. People want to know, when's SLS going to be ready. I would say the question should be when are SLS and Orion going to be ready in an integrated package, and right now we're thinking that that's, we're still saying we think that's going to be the 2017 time frame. That's our target. Once we get the two married up in terms of the key decision point, we'll be able to tell you for sure, okay, the integrated package is going to be ready for launch in December of 2017 or some, whatever date it is. If I don't get money to bring about commercial capability, then we will have to revert to government capability to get our astronauts to low earth orbit, and that will divert funds away from exploration, away from the mission for which SLS and Orion have been designed, and I said I would not do that. In an effort to try to keep commercial interests interested in developing a crew vehicle, I promised them that Orion would not be configured such that it was optimized to go to low earth orbit, to the International Space Station.

If we had done that, commercial entities would have just, they would have run away because they know they can't—if NASA decides it's going to do low earth orbit access, why should any company try to compete with us? You know, if I'm doing it, I'm going to justify doing it. We always do that. Government always does that. If I'm spending money on something, am I going to say, yeah, I've got it, but I want to give you a chance? No, we won't. It is still a competitive environment, and we tried to take government out of the competition for low earth orbit access. I think we've successfully done that. I don't have a capability to get cargo to low earth orbit except Orbital Sciences and SpaceX, and I think that's the way it should be. As Mr. Culberson said, you can go to the Yellow Pages, and there are at least two companies in the Yellow Pages now for cargo to low earth orbit that are American companies. Prior to the last couple years the only companies in that Yellow Pages were foreign carriers.

Give me what we're asking for commercial crew, and in 2017 when you go to the Yellow Pages and say I want to get a crew anywhere in low earth orbit, you're going to have at least one American company, so—but if I down-select to one right now, the competition goes out the window, the price goes off the page, and 2017 may go out the window. So it is a very delicate balance that we're trying to maintain here. It's simple business, you know. I'm trying to learn from you all about simple business. Business says when there's competition, the price goes down. When there is monopoly, the monopoly controls the price. That's why I pay what the Russians ask for a seat on Soyuz. Why? Not because I like to, but because that's the only way I have to get my crews to space.

OPTICS TEST TECHNOLOGY

Mr. ADERHOLT. Thank you, Mr. Chairman.

Mr. WOLF. Mr. Fattah.

Mr. FATTAH. Thank you. There's almost no disagreement or light between those of us on this committee, even though we wear different jerseys when it comes to NASA, and we want to make sure that you can continue to be the preeminent organization in the world in terms of space exploration. But the Congress has its own responsibility to bear in these matters, okay? So it wasn't the Obama administration. It was the 2006 CR that underfunded Constellation.

Mr. BOLDEN. Yeah.

Mr. FATTAH. This is before Obama was sworn in, before you ran NASA, and nobody probably on this panel had much to do with that CR at that point, but that is the origins of the cancellation of Constellation. We just need to put this in perspective. But I want to go on to some of the things where we do agree, right?

So in terms of the optics technology that DOD, the Intelligence Community, NASA, everybody is interested in, that will be, I think, useful, here on Earth and interms of Saturn and this ocean in one of its moons, which is an exciting find. These will usher in more investment in space technology.

Mr. BOLDEN. Yes, sir.

Mr. FATTAH. And I want you to talk about the optics tech that's necessary.

Mr. BOLDEN. Well, I mean, the Europa mission for example, when we, not if, when we fly the Europa mission, if we have perfected optical communications, laser com, whereas it would take, I would have to pump data images from Europa up to a satellite, hold it, and dump it back to Earth over days or weeks or whatever. With optical communications, the pipe is going to be incredibly enlarged, and I can get much more data back to Earth real-time than I can with today's technology. That's very important for a scientist who is interested in studying the outer planets—

Mr. FATTAH. Right.

Mr. BOLDEN [continuing]. Optical communications is going to be absolutely incredible because of the amount of data. We flew a test on LADEE. As I said, we're still on the Moon, we have LADEE, let me put it this way, fortunately LADEE is going to crash into the moon the end of this month. Now, you may say why do I say that's fortunate? Because that's one mission we don't have to fund, and we can take that money and put it toward another science mission that will study the Moon or Mars or somewhere.

So that's one way to answer the question about how long do you fly an extended mission. LADEE was planned to do this, and so it will come to its planned end, but while it's flying, we have a laser communications experiment. We have pumped imagery, voice, and data at Internet speeds whereas if we were doing it, over S band or some of these other frequencies, it would take days to do that. So those are the kinds of technology developments that are going to be really important.

COMMERCIAL CREW PROGRAM CONTINUED

Mr. FATTAH. At the tail end of my colleague's question you said we'll be able to fly—if we have this competition on commercial crew—

Mr. BOLDEN. Yeah.

Mr. FATTAH [continuing]. We'll be able to fly crews anywhere we need to on low earth orbit. I don't want that understatement to stand as it is. That means that we would be able not only to supply the space station, but that if we wanted to go to other places in low earth orbit, the commercial crew competition is important to that because NASA's focus is on deep space travel, right? That's what we're funding. And so commercial crew and—

Mr. BOLDEN. Yeah.

Mr. FATTAH [continuing]. The competition therein is critically important.

Mr. BOLDEN. In our arguments back and forth, in our talking past each other, I think a lot of people have missed the critical importance of Space Act Agreements.

Mr. FATTAH. Right.

Mr. BOLDEN. When I made a decision a little bit more than a year ago that we would extend the use of Space Act Agreements in the development of commercial crew, I made it for several, what I thought were important reasons. One was it would enable us to maintain competition for as long as possible. If we had had to down-select at that time based on the amount of money appropriated, I have no idea what the date would be when commercial crew would finally become available, and I have no idea who the contractor would have been that we would have awarded that amount of money to. You know, everybody thinks about—

Mr. FATTAH. I just didn't want—because I think it's important to note that, you know, in terms of returning to the moon or doing other things that the private sector capacity to do so, and Nautilus, I think it's your catalyst program?

Mr. BOLDEN. Exactly.

Mr. FATTAH. Is part and parcel of that, that that is, continues to be being ramped up.

Mr. BOLDEN. You can ask Mr. Bob Bigelow about the importance of commercial crew and cargo. He's waiting to put some modules up. He's got them already made. He's not—

Mr. FATTAH. I think the thing that might get a lot of our young people interested is your space suit competition.

Mr. BOLDEN. Yeah.

Mr. FATTAH. The public vote, and that's going to be rolled out in—

Mr. BOLDEN. Yeah.

Mr. FATTAH. I know one that of the entrants is from Philadelphia University or, chairman, it used to be called the Philadelphia College of Textiles and Science, but it's now called Philadelphia University. So I'm not trying to put a plug in for the home team, but I am trying to put a plug in for the home team, and so I thank you and I yield back to the chairman.

ASTEROID REDIRECT MISSION, CONTINUED

Mr. WOLF. Thank you, Mr. Fattah. I'm not going to go into the moon again. I just want to just cover one thing for the record—

Mr. BOLDEN. Yeah.

Mr. WOLF. Dr. Carnesale and the National Research Council completed a review of NASA's strategic direction, which was di-

rected by the committee. He said, "The more we learn about the asteroid mission, the more we hear about it, people seem less enthusiastic about it," but he added "There's a great deal of enthusiasm almost everywhere for the moon." Neil Armstrong, who we all respect and I know you do, too, said shortly before he died, "I am persuaded that a return to the moon would be the most productive path to expanding the human presence in the solar system." Almost everyone that we talk to seems to agree with that.

INTERNATIONAL SPACE STATION

NASA has recently announced its intention to extend the life of the International Space Station from 2020 to 2024. The Station's international partners, however, have not all agreed to the extension or committed any of their funds to it. What is the status of your discussions with the ISS partners about extension, and when do you expect that a Station extension plan could be finalized?

Mr. BOLDEN. Mr. Chairman, if I use the example of the extension to 2020, a public fact but a little known fact is that the Canadians just signed on to 2020 last year, so it is a multi-year process to go back and work with the international partners and get them to adopt what the United States proposes as policy for the International Space Station. The Russians have signed up almost right away, so right now, Mr. Ostapenko and I were the first two signatories on a document that talks about the global exploration road map and our reliance on it and extension of the International Space Station to 2024, but just like us, they have to go back and get financial approval from the Duma to fund to 2024.

We will have to get financial support from the Congress to support 2024. I have visited Japan and I have talked with members of the Diet, they have a group that's called the Dynamic Future Dreamers, and they are about 30, 40 Diet members who are avid space enthusiasts, and they have pledged that they will help to get, convince the Diet to follow the United States' lead and agree to 2024 extension. I went and met with members of the French Parliament. They have a group that's called the, I want to say it's the Parliamentary Space Group led by the head of the Senate, who is equivalent to the Vice President of France, who is a space enthusiast, who says that they will work enthusiastically to try to get the French Parliament to endorse adoption of President Obama's plan for extension of the International Space Station.

So that would leave us, if the Europeans come on board and their head right now, Jean-Jacques Dordain, is fully supportive of 2024. That would leave us again with only the Canadians to engage. The head of the Canadian Space Agency supports it, but he's got to go back and get approval from the Canadian Parliament, just endorsement from the Canadian Parliament, so it's a multi-year process.

Mr. WOLF. So there are a number that have not yet?

Mr. BOLDEN. No one except Russia and the United States have adopted it by putting a name on a dotted line. It's like Congressman Culberson said about a presidential proposal, you know the budget submission, the President proposes and Congress disposes. The U.S. proposes with reference to the U.S., to the International Space Station, and the partners dispose because they have to provide funding, and they all now are trying to make sure that they

can provide funding through 2020, so they've got to wrestle with how they get—we are confident that they all will come aboard, just as it took the Canadians quite a long time to come aboard, but we think they will, but that's an ongoing process that we continue to work.

Mr. WOLF. As recently as 2 weeks ago, you told the Congress that events in the Ukraine were having no impact on NASA's cooperative relationship with Russia. Six days later, however, NASA announced an indefinite suspension of all joint activities, except for Space Station operations. What happened in those 6 days to change your opinion?

Mr. BOLDEN. Mr. Chairman, what's more important is what happened immediately after that was reported, because that was in error. We did not announce a cessation, it was reported in the Russian press and in the U.S. press that NASA had announced a cessation of all cooperation with the Russians, and that was not true. We have gone back. The process being used now through the inter-agency process that we always utilize is on a case-by-case basis. We get an activity excepted from any prohibition of cooperation. The International Space Station was excepted immediately, so that was never in question, so that relationship with Roscosmos and the International Space Station was never really in jeopardy.

Subsequently we have gone back and we have gotten a case-by-case excepted status to things like COSPAR, which is one of the largest scientific forum, international, multinational, but it's hosted by the Russians in Moscow this coming year. So in order to allow NASA scientists to go, we had to get that put on the list of excepted activities, and we've succeeded in doing that. We cooperate with the Russians on Curiosity, they have the radiation monitoring instrument DAN on Curiosity, we went in on a case-by-case basis, and we got that excepted. So our relationship, as I said before, with Roscosmos continues to be very good.

Our relationship with other Russian entities we work on a case-by-case basis. I want to say we have three different activities right now that we are in the process of requesting exception for, but they really are a bilateral. There's no multilateral relationship there, and they are lesser types of projects, or projects that are in the making, that haven't started yet, and we're requesting exception. So the unfortunate thing was that the headline was wrong.

Mr. WOLF. Do you have any contingency plans for Station operations in the absence of Russian support? What if they were to say that they're not going to support it anymore? Reports were they were not going to go into the Crimea but they did, and we read in today's Washington Post what they're doing in cities there. Do you have a contingency plan should they go out of the partnership?

Mr. BOLDEN. As I mentioned earlier, Mr. Chairman, when Dr. Harris asked a similar question, if the Russians were to say they are not going to support, that would only impact two things, two critical things. It would impact the ability to get crews there because they provide transportation. It would impact the major means of propulsion for station, but as we have demonstrated before, while the Russian power and propulsion module, Zarya, is the largest and the primary means of maneuvering station, frequently we will use the Japanese module when it's there, we'll be able to

use Cygnus or we may be able to use SpaceX Dragon. We have other ways to maneuver the International Space Station, so the big thing for us is access, and the big thing for the Russians is day-to-day operations, it's environmental control and life support, it's almost everything else that has to do with the International Space Station, it's access to laboratories, so the people that would really be hurt by a break in our relationship with Roscosmos would be the Russians.

Mr. WOLF. But do you have a contingency plan?

Mr. BOLDEN. Our contingency plan is to keep working to maintain that partnership, as vibrant as it is, while we allow the State Department and the National Command Authority to work the political and diplomatic issues.

Mr. WOLF. Well that hasn't gone very well so far.

Mr. BOLDEN. But that's not my job, and I don't mean to be that—that's a flip response, and I don't want to say that. I try to stay out of diplomacy and politics. I'm certain the State Department and the National Security Council would be very angry with me if I did, if I met with members of the Duma, and I have done that before, but it's been with approval of the interagency process that I am going to talk to them about a very specific thing, extension of the International Space Station to 2024. When I meet with members of the French Parliamentary Space Group, that's getting into diplomacy if you really look at it, and so I get that approved through the interagency process, and that is all I do is I talk about the specific topic that I have approval from the State Department and others to talk about. I am not authorized nor do I want to be involved in talking to the Russian government about our relationship on the International Space Station.

Mr. WOLF. I understand. But we have not had cooperation from the Russians on Syria, nor have we had cooperation on Crimea.

Mr. BOLDEN. I understand, Mr. Chairman, but I am saying the part that we are responsible for negotiation and partnering is working very well, and I continue to work with my American partners, to be quite honest, the State Department, National Security Council, and others, to make sure that if at all possible, they keep the International Space Station above the fray. If they're as good as I hope they are, then we'll stay above the fray.

COMMERCIAL CREW DEVELOPMENT AWARDS

Mr. WOLF. I'm going to go to Mr. Honda in just a second. One more to think about.

NASA has stated its desire to maintain multiple companies in the next round of commercial crew development awards and to have a domestic crew capability in place by, as you said earlier, 2017. Its ability to achieve both of these goals, though, hinges quite significantly on how much money NASA's industry partners say they will need to complete their development process, and that information is currently subject to a procurement-based embargo. How long do you expect that embargo to last?

Mr. BOLDEN. The blackout will last until the announcement is made, hopefully in August. That will be when the announcement is made, and the selection will be based on two things. One will be the amount of money in the 2014 appropriations, and as I said in

my opening statement, I'm very thankful to the committee for the amount you appropriated, the increase to 696 was really, really helpful in giving us hope that we'll be able to have more than one provider and that we will be able to make 2017, if we're able to get the President's request of \$848 in 2015, and it's our hope that we will have some indication as to how that's going before the decision is made in August, and that would also influence the number of providers that would be selected by the selecting official.

Mr. WOLF. I doubt there will be a final bill passed by then.

Mr. BOLDEN. But, generally what we do in planning is we look at what the House Authorization Committee, Appropriations Committee says and the Senate Appropriations Committee, and we keep our fingers crossed that the number we finally get is going to be bounded by those two numbers. If you give us a good number for commercial crew, just to be very candid, generally the House number is a little bit lower than the Senate number, so if I get a good number from the House no matter what it is, then we will take a look at that number added to what we have for 2014, and that will help us determine how many we can select, whether it's one, or one and a half, or two, or whatever.

Mr. WOLF. Mr. Honda.

Mr. BOLDEN. So it is very important to get an indication from this committee as to what it is you're taking to the negotiating table for ultimate negotiation. Yes, sir?

STRATOSPHERIC OBSERVATORY FOR INFRARED ASTRONOMY (SOFIA)

Mr. HONDA. Thank you, Mr. Chairman, and welcome, Mr. Administrator. I'm a bit troubled by the President's proposed defunding of the Stratospheric Observatory for Infrared Astronomy, better known as SOFIA. This airborne telescope is our Nation's only far infrared observatory, and after a decade of development, only just became fully operational this past February, a couple months ago. We spent 60 percent of the total cost, which was near \$1.2 billion, and yet the program has acquired less than 5 percent of the data planned, so now that we are starting to finally reap the scientific benefits, NASA is planning to cut the program?

The administration claims SOFIA is being cancelled to provide funding needed for higher priority projects, but this statement directly conflicts with NASA's fiscal year 2014 budget request, which said SOFIA funding was essential because SOFIA will soon be NASA's only, only far infrared mission as Spitzer's cryogenics have been depleted and Herschel's cryogenics will be exhausted by mid-2013.

It is the only mid infrared mission until the James Webb space telescope becomes operational in 2018. Spitzer and Herschel's cryogen are now depleted, SOFIA is our only far infrared mission, so SOFIA has been a top priority of the astrophysics community for years, as is noted in the astrophysics, the keyhole surveys, it's been a top priority of NASA, as demonstrated in previous budget requests to this committee, and now that SOFIA is just starting to become operational and provides unique scientific insights into the universe, the administration is planning to cut it.

So the question is, what specific scientific and technical review and analysis was performed during the fiscal year 2015 budget formulation process to support NASA's proposal to cancel SOFIA?

Mr. BOLDEN. Mr. Honda, if I can—let me go back, first of all, and say the President's proposal, our proposal to suspend operations on SOFIA is a proposal. We continue to operate SOFIA by the original 2014 plan, so we've got more time in this fiscal year. We put together a NASA/DLR German task force to take a look at SOFIA, its cost, potential sources of additional funding that would enable us to continue to operate it into the future, and so that work is not done. So we have not made the final determination that SOFIA will be put into mothballs or whatever it is, but that is the proposal.

The process in which we engage was a typical one where the science mission directorate looks at the priorities on other astrophysics missions, they looked at the functioning of existing missions, and as you mentioned Herschel, other satellites that we are hoping that SOFIA would be able to replace continue to function. Their projected failure, which is what it is, we're looking, we're saying we don't think they have enough cryogenics to be able to go beyond X date.

As Congressman Schiff pointed out earlier, one of the down sides of our goodness is we generally are wrong in our projection of the end of life for things that we have built, and they last longer than we thought.

So we still have the capability to get data in the range that SOFIA would be doing. SOFIA does have some unique characteristics that we would like to have, but the astrophysics community did not have SOFIA ranked high enough in their prioritization that when we had to go through the types of budget exercises we did leading up to sequester. SOFIA did not make the cut line, if you will, where we thought we would be.

Mr. HONDA. So we stepped beyond sequester.

Mr. BOLDEN. Well, we're not beyond sequester. We have a 2-year hiatus, and with no indication that we are not going to go back to where we were before, and if we go back to where we were before, then SOFIA and a number of other projects go away.

So SOFIA just did not rank high enough on the list of scientific priorities because we still, and, I'm not a planetary scientist or an astrophysicist, but as they explained to me, we do still have sources of getting the data that SOFIA would provide. So it's not that by not flying—we've been getting that data up until SOFIA started flying last year, so we are still looking for ways to save SOFIA.

Mr. HONDA. The response is appreciated but not sufficient in my mind—

Mr. BOLDEN. I don't—

Mr. HONDA [continuing]. Because if we're talking about limited funding in the next couple of years because of sequestration, perhaps the decision was based upon that, and I see much more than that, so I would suspect that revisiting the issue and the question might be pertinent.

The other thing is that the other two satellites, they're orbital, and they're going to deplete sometime.

Mr. BOLDEN. Yeah, at some point.

Mr. HONDA. SOFIA has the ability to regenerate itself because it's not fixed. We bring it up there and we can bring it back down. So that flexibility seems to be an advantage that we should be looking at in order to sustain that kind of probe in science effort. So I guess I would like to hear from you in the near future to go back to that community and find out whether they've changed their minds based on the change in the scenery.

Mr. BOLDEN. And that's exactly what we're trying to do. We expect to have a report out of the bilateral working group by the end of this month. That will be DLR and NASA astrophysics people saying here are proposals that we have come up with to preserve the capability of SOFIA for the future. We have a solicitation out to see if there are other potential partners, whether international or agencies, other agencies of the government and the like. That will tell us a lot. If SOFIA is as important as some in the science community say, my guess would be there will be people standing in line to add their funds to maintaining SOFIA. It's like I get notes from kids all the time with a dollar that they want to make sure that NASA keeps doing stuff. I would expect that we will see people who don't fund SOFIA today that will be willing to help fund it in the future because they will get data from it.

Mr. HONDA. Yeah, I just have to go by your terminologies like the question is, I'm asking if you're cutting the program. You said no, it's a proposal.

Mr. BOLDEN. Yes, it is.

Mr. HONDA. Well, and then you're working with your partners, your partners are Germany, and they're putting in probably about 20 percent of the total cost.

Mr. BOLDEN. That's right.

Mr. HONDA. And we're 60 percent expended the amount allotted and authorized. Are you saying that the proposal and the effort will continue until the 40 percent is expended and we'll see after that or—

Mr. BOLDEN. I am saying that we are making an effort to find ways to fund the operation of SOFIA. When we went through the process of evaluating which astrophysics missions would go, there was no other astrophysics mission, that would provide the level of funds that we could take that single mission away and get the same result with the budget that we did with SOFIA. We could peanut butter spread it, and then what we would do would be to degrade the capabilities of multiple astrophysics missions.

Mr. HONDA. Mr. Chairman, just one last question. The information that you would extract from the far infrared observation further out, what value does that have with all the other programs that you are supporting to move forward in in space exploration?

Mr. BOLDEN. I asked that question yesterday, and again I'm going to—I'll take it for the record to get you the precise answer, but when I asked this question yesterday, they're looking at organics in the atmospheres of other planets. Because it's infrared, it can see through things that Hubble, for example, can't see, but once it discovers that there's a region that we want to explore, it's not going to be SOFIA that does that. James Webb is then going to hone in on that particular area.

Over time, you might get the same information from James Webb, but as they explained it to me, and I think I understand it, James Webb is sort of like looking for a needle in a haystack until it gets some specific data. SOFIA, because of the wavelength in which it looks, just sweeps through and, boom, it just comes up on an area of interest that we then use another instrument to get the critical data that we need. But, that's why I say, its wavelength is unique in its ability to cut through other galaxies and other planetary systems, that the survey instrument, it would be a waste of time and money to allocate it to looking out broadly, hoping that it finds something.

Mr. HONDA. Thank you, Mr. Chairman. I look forward to a response on the other questions.

Mr. BOLDEN. Okay.

[The information follows:]

STRATOSPHERIC OBSERVATORY FOR INFRARED ASTRONOMY (SOFIA)

SOFIA's current suite of instruments is optimized to provide imaging and spectroscopic capabilities in the 1–250 micron wavelength range. SOFIA is designed to be synergetic, not redundant, with other infrared missions. For example, at near and mid-infrared wavelengths (0.6–28 microns), the James Webb Space Telescope (JWST) is optimized for very faint targets, a capability that necessitates lower resolution spectroscopy, which will be appropriate for observing distant galaxies. By comparison, SOFIA's high spectral resolution capability over the same wavelength range is the only suitable "tool" currently available to astronomers to study the motions and chemical composition of closer, brighter objects in the Milky Way and nearby galaxies. For example, SOFIA will enhance the study of planet forming disks around stars, which requires extraordinary spectral resolution in order to resolve velocity structure, and study of the chemistry of the interstellar medium, which requires very high spectral resolution to identify new chemical species and distinguish different chemical species and their isotopic variations. (Unique targets observed by SOFIA, as well as other observatories, can be followed-up by JWST.) SOFIA will also have the capability to study magnetic fields at infrared wavelengths, thereby addressing questions about the role of magnetic fields in the star formation process. With the recent decommissioning of the Herschel Space Observatory, SOFIA will provide astronomers the only access to the far infrared spectrum (Herschel observed in the 55–672 microns wavelength range), for at least a decade or more based on current development plans for future space missions. Lastly, SOFIA currently provides data at infrared wavelengths to supplement data obtained by other NASA Astrophysics missions, from high-energy gamma-ray (Fermi, Swift) and x-ray (Chandra, NuSTAR) observatories, through the ultraviolet and optical regions (Hubble) and the near-infrared (Spitzer). This type of synergy provides a more comprehensive understanding of astronomical phenomena.

Mr. WOLF. Thank you, Mr. Honda. Mr. Culbertson.

INTERNATIONAL SPACE STATION, CONTINUED

Mr. CULBERSON. Thank you. General Bolden, if I could follow up on a question that Chairman Wolf was asking about contingencies in the event the Russians invade the Ukraine, in this morning's Washington Post, he's correct, it has got a disturbing story. We know there is tens of thousands of Russian troops massed on the eastern Ukrainian border, and Secretary Kerry announced this morning in that Washington Post article that he's absolutely convinced that it's Russian special forces are the ones responsible for stirring up the agitation in eastern Ukraine. There are still individuals holed up in one of the Ukrainian government offices in Donetsk, and they've erected tires, barbed wire, and the dispute everyone believes is going to be used by the Russians as an excuse

to go in and invade the Ukraine. Things would deteriorate fairly rapidly in that event, and the Air Force has contingency plans.

They've already, they have a stockpile, I'm looking at the March 24th issue of Aviation Week & Space Technology on page 28 points out that to mitigate concerns about supplies because of what's happening in the Ukraine, the Air Force maintains a stockpile of roughly 2 years worth of the RD-180 engine that is built by Lockheed Martin under a license with the Russians, and if—Aviation Week points out if Russia were to hold the RD-180 hostage, the Defense Department estimates it would need \$1 billion over 5 years to establish production on U.S. soil.

So the Air Force has a contingency plan, and I wanted to follow up on Chairman Wolf's very, very important question and specifically of course, not only because of the concern that Congress has but also for the, frankly, you know, for out of concern for, you know, astronaut Steve Swanson who is a flight engineer on the ISS right now, and NASA astronaut Rick Mastracchio, who is also a flight engineer, and for their families. What is NASA's contingency plan in the event—

Mr. BOLDEN. Contingency plan for deorbiting any crew at any time is they become a crew member on Soyuz. We have two Soyuz, if you want to call them emergency return vehicles, and so they would—if the decision were made to de-man the station, the six crew members on board would get into the two Soyuz vehicles there, and they would return to Earth. That's the contingency plan. That has always been the contingency plan.

Mr. CULBERSON. Okay, that's I think what Chairman Wolf was asking. We just want to make sure—

Mr. BOLDEN. I thought the chairman was asking for something far more broadly, how do we continue to operate, and if that was not your question, then I answered the wrong—I took the chairman's question to mean what is our contingency plan for continuing to operate the International Space Station if the Russians decide that they're leaving the International Space Station because, as I explained—

Mr. CULBERSON. That's in the question as well.

Mr. BOLDEN. The Russians have two things: They have Zarya, which is propulsion, and they have Soyuz, which is access. They don't run the International Space Station. They are—and I don't—I want to mark, I'm not going to say, I'm going to be careful. We could continue—if we had access to the International Space Station, we could continue to operate the International Space Station until that access went away. Our contingency plan, if you want to use a similar, if you want to equate ours to the Air Force's, and if you could read me one more time—

Mr. CULBERSON. Sure. Yes, sir.

Mr. BOLDEN. What was the length of time that the Air Force said for development of the—

Mr. CULBERSON. Air Force has a 2-year supply of engines on hand.

Mr. BOLDEN. I know that because I talked about that earlier with Dr. Harris.

Mr. CULBERSON. Right.

Mr. BOLDEN. But that it would take X billion.

Mr. CULBERSON. \$1 billion.

Mr. BOLDEN. Which is not budgeted yet.

Mr. CULBERSON. In order to establish production on U.S. Soil.

RUSSIAN RELIANCE

Mr. BOLDEN. In the next 2 to 5 years, our contingency plan is to take \$848 million to give to an American company that in the next 3 years, a defined period of time for a defined amount of money that is in the President's budget. The billions of dollars that the Air Force says they would need to do, replacement engine, that's not in the budget yet. Look, realistically here, we have the best contingency plan of anyone, and our contingency plan unfortunately has a 3-year time horizon. The Air Force's contingency plan has a 3- to 5-year time horizon and no budget. So I would take where I am. I can get one provider on what I have from the 2014 budget. Unless the Congress decides that okay, we've had it with commercial crew. If you wanted to stop me from providing transportation to my crews—

Mr. CULBERSON. No one has suggested that.

Mr. BOLDEN. But you asked the question.

Mr. CULBERSON. Nobody has ever suggested that.

Mr. BOLDEN. So the answer to the question is, my contingency plan is a robust commercial crew program available in the next 3 years at the cost of \$848 million in the 2015 budget.

Mr. CULBERSON. Yeah. Two of—under what circumstances would NASA abandon the space station?

Mr. BOLDEN. I cannot foresee of any circumstances short of the National Command Authority directing NASA and all government entities to curtail all activities with any branch of the Russian government, that's the only reason we would abandon the station, and I don't see that. That could happen, Congressman Culberston, but the station is too valuable right now to too many nations for us, to sit around and think about how do we abandon it. We need to be thinking about how we maintain our capability to operate there.

My answer to you will be the same until the cows come home, \$848 million in the 2015 budget, and I can guarantee you we will have access to the International Space Station through American providers in 2017. That's my answer. That is my contingency plan.

Mr. CULBERSON. Two of those—

Mr. BOLDEN. And I think that's a pretty good contingency plan.

Mr. CULBERSON. But two of those commercial crew providers use that Russian engine.

Mr. BOLDEN. Do you know who is bidding on commercial crew? I don't. I don't know who the providers are. I don't know what platform they're planning to use. Sierra Nevada, I hope, is one. Sierra Nevada, to my knowledge, is not using Russian engines.

Mr. CULBERSON. Well, I do—

Mr. BOLDEN. SpaceX I hope is a bidder, and they're not using Russian engines.

Mr. CULBERSON. Well, the—

Mr. BOLDEN. We have American capability to do what we want to do if we fund it, if we trust American industry without any reliance on Russians, without any reliance on Russians.

Mr. CULBERSON. I think what the chairman is asking, and all I'm really driving at, too, you know, you've got no better—

Mr. BOLDEN. I answered the chairman's question, I think I'm trying to answer your question right now.

Mr. CULBERSON. You've got no better group of friends up here than this subcommittee, and we're just trying to get a handle on whether or not you have made contingency plans.

Mr. BOLDEN. Congressman Culberson, you're not accepting my answer. My answer is I have a 3-year, \$848 million contingency plan. That is my answer, you may not like that, that may be unacceptable to this committee.

Mr. CULBERSON. Well, no, 3 years—

Mr. BOLDEN. But I think my contingency plan is better than what you just read to me that the Air Force says their contingency plan is, because they've got to convince the President and the Congress to put an extra couple of billion into the budget, which I support, by the way, because we're a part of the engine initiative that I responded to Dr. Harris earlier. I said we don't know how much it's going to cost.

Mr. CULBERSON. The Air Force's contingency plan was to develop a 2-year stockpile they've got on hand. I'm talking about short-term contingency plans.

Mr. BOLDEN. Yes, yes.

Mr. CULBERSON. That's what we're driving at. And SpaceX's CEO, Elon Musk, referring to the same article on the March 24th Aviation Week, Musk has suggested the Pentagon eliminate its dependence on the Russian engine by using the SpaceX Falcon 9 version 1.1 in place of the Atlas 5. So the private sector's developing alternatives and contingencies, and I think that's all we were trying—all we're trying to determine is what—

Mr. BOLDEN. And that's funded by us, funded by NASA. Elon Musk can say what he can say because NASA invested in SpaceX.

Mr. CULBERSON. Yeah. Both of the Boeing, my staff just handed me a note that the Boeing CST-100, the Sierra Nevada Ocean Dream Chaser both use the Atlas vehicle, and, of course, the Atlas is powered—

Mr. BOLDEN. Okay, I didn't know that, okay? I knew that Boeing had talked about using—

Mr. CULBERSON. They're talking about using the Atlas.

Mr. BOLDEN. I am not trying to be cute. I am not the selection official, and in a blackout period I don't know whether we have five companies that have submitted proposals or one company, so I don't know, and that's all I said.

Mr. CULBERSON. I think all we're looking for is to know that you're thinking about this. We would like to know that you're working on this. For something short term—

Mr. BOLDEN. Mr. Culberson, I'm working really, really, really hard on it, and I have told you my contingency plan is \$848 million requested by the President and reliance on at least one of those American companies that I hope has a proposal in. Now, if SpaceX, Sierra Nevada, Boeing, some of the others didn't put a bid in and I have none, then my contingency plan goes up in smoke. I need for at least one of those companies to have bid. But because we're in blackout I do not know who submitted a bid.

ASTEROID REDIRECT MISSION, CONTINUED

Mr. CULBERSON. I also want to make sure to get in for the record that there was a hearing before the subcommittee on the authorizing side last May specifically on the asteroid retrieval mission, Steve Squyres who is the—again, Steve Squyres, pretty important guy, he is chairman of—

Mr. BOLDEN. He's very important, he's the chairman of my NASA Advisory Council.

Mr. CULBERSON. And in his testimony last spring, Squyres found no connection between the asteroid retrieval mission and Mars exploration, adding that he does not see the need for landing on any surface, the moon, an asteroid or any one of the moons of Mars as preparation for landing on Mars. He believes the capability needed to go to Mars can be demonstrated in Cis-lunar space, given the performance capabilities of SLS and Orion, it is the only significant destination beyond low earth orbit that can be reached for the foreseeable future, and his opinion was shared by the head of the Lunar Planetary Institute, they didn't see any connection between the asteroid mission and going to Mars as well as the, as well as Doug Cooke, who was head of NASA's Exploration Systems Mission Directorate until 2011. Knowledgeable, capable people, but the—it's just, I think, important to remember that the asteroid retrieval mission again, as Chairman Wolf has said, has just not generated that much support or interest in the Congress.

Mr. BOLDEN. Mr. Culberson, quite the contrary. What you cite from Dr. Squyres is more than a year old, and even in his statement, he said Cis-lunar space, if you look at that chart where it says proving ground, that's Cis-lunar space, that's what Steve Squyres is talking about.

Mr. CULBERSON. Right.

Mr. BOLDEN. He is saying that's where you develop the technology.

Mr. CULBERSON. That's correct.

Mr. BOLDEN. That is exactly—

Mr. CULBERSON. Not necessarily like pushing a rock into that location.

Mr. BOLDEN. We are trying to get to Cis-lunar space. The asteroid redirect mission allows us to get to Cis-lunar space. It has a number of requirements that it levies on us. Solar Electric Propulsion, I don't need solar electric propulsion to fly SLS and Orion to Cis-lunar space. I can fly them there and then what do we do?

Mr. CULBERSON. We support you, we're going to do everything we can to help NASA.

Mr. BOLDEN. Mr. Culberson—

Mr. CULBERSON. You know how much we love you and support you, but there's—

Mr. BOLDEN. We are developing technology in Cis-lunar space—

Mr. CULBERSON [continuing]. Not a lot of support for this asteroid mission in Congress.

Mr. BOLDEN. The asteroid redirect mission levies requirements on us for technologies that Steve Squyres is talking about, but Steve, as he told me, I know exactly what he is talking about be-

cause I talk to him regularly, he's the chairman of my NASA Advisory Council. I think if you brought Steve Squyres in here today he would say something different to you. Mr. Honda and I have looked at some of the stuff together out of the Ames Research Center. That's a year old.

Mr. CULBERSON. I understand.

Mr. BOLDEN. The technology is moving much more rapidly than anything you can quote from a report—

Mr. CULBERSON. I'm going to wrap up, but—

Mr. BOLDEN [continuing]. From a year ago.

Mr. CULBERSON. I'll wrap up, sir. But the money is so tight, we're just concerned about making sure that you have got the resources you need to do your core missions.

Mr. BOLDEN. Mr. Chairman—

Mr. CULBERSON. Thank you.

Mr. BOLDEN. Mr. Chairman, with all due respect, I've given you my contingency plan. I realize how tight money is, I am saying I only need \$848 million of it.

Mr. WOLF. Mr. Fattah.

Mr. FATAH. Mr. Chairman, I think whatever other questions I have I'll submit for the record, but I think it's been very helpful so far.

AERONAUTICS

Mr. WOLF. Thank you. On aeronautics, after a long run as an undisputed leader in aviation technology, the United States has begun facing aggressive, focused global competition. The best way to ward off this competition is through the development of new technologies that will protect the American market share, but we appear to be following the opposite strategy. As global competition has intensified, investments in NASA's aeronautics program, which would likely develop those game-changing new technologies, have decreased substantially.

The program is currently close to 40 percent smaller than a decade ago, and NASA is once again proposing a cut in its annual aeronautics budget. How can we sustain our aviation leadership with shrinking R&D support?

Mr. BOLDEN. Mr. Chairman, in fact, the aeronautics program has redirected its strategy. It now has six strategic thrusts, that they have gone out and worked with industry to look at where we need to focus our efforts. Given the amount of money we have dedicated to aeronautics, and we feel that we are, those six thrusts will keep America at the forefront of development of the aeronautical systems. We are working on integration of unmanned aerial systems into the national air transportation system, we're looking at ways to be environmentally responsible by reducing emissions, reducing noise, and increasing speed of airplanes that fly today.

We have released already two specific software packages to the FAA that allows them to get aircraft off the runway and to their cruising altitude much faster. That is documented savings of hundreds of millions of dollars to, hundreds of thousands of dollars to aircraft companies that have been test with us. We're about to put a test in place at Charlotte Airport with US Airways on a ground radar system and a ground management system that will increase

the efficiency of airplanes getting from the gate to the runway for takeoff, and that's just the change in direction that aeronautics has made because we're trying to do what the industry needs for us to do to keep them competitive. It's the largest balance of trade item this Nation has, and we're trying to keep it robust and number one, and I think we're doing that.

Mr. WOLF. Well, I think we are falling behind. Mr. Aderholt, do you want to go?

Mr. ADERHOLT. Yeah.

Mr. WOLF. Yeah, I'll go to Mr. Aderholt. I'll come back to this. Go ahead.

UPPER STAGE USAGE

Mr. ADERHOLT. I understand the interim cryogenic propulsion upper stage would make sense for one or two missions, but have started more robust work now on the SLS upper stage that creates at least two significant possibilities. Only the SLS with the robust upper stage can carry the biggest possible Europa mission, and it will get the results back to the scientific community in less than half the time of current rockets. Also, there's significant interest by international partners in moon-related missions. Meanwhile, a few minutes ago you mentioned Bigelow. They have proposed modules which could be a useful addition to the space station as well as platforms for orbiting or landing on the moon.

Mr. ADERHOLT. Tell me what would be the problem if we moved ahead with substantial work on a robust upper stage and designate SLS as the vehicle for the Europa mission; secondly, that we plan an SLS mission involving international partners and additional commercial companies, a mission involving either the International Space Station, the moon, or both, something that would be possible only with an SLS rocket.

Do you believe there is congressional support for these two ideas?

Mr. BOLDEN. I would hope so, because we're embarked upon some of those things that you just mentioned.

We don't know yet whether the science community is warming to the use of SLS as a launch vehicle for Europa. This is an idea that has just come forward in the last 12 months. I think Congressman Culberson knows, it's just been the last 12 months that we've actually started saying, if we launched a Europa mission on an Atlas V, the way we traditionally would do it, it would have to go out around Venus or go around some other planet, and it's about a 7-year mission to get there. If we launched that same mission, we think, on an SLS, it's a direct flight, and it gets there in about 4 years prior to the Atlas V that launched that same Europa mission. That is a technological gain just by developing SLS. So we are looking at that, but we're not at the stage where we're willing to make that commitment yet. But the science community is trying to warm to that.

In terms of why not commit to an upper stage, it's because that would mean that we have decided to abandon an advanced booster. The decision process in which we're engaged right now with SLS is, do we go with an advanced booster to give us the larger capacity or do we go with an advanced upper stage? You don't need both. The advanced booster with the interim upper stage or the advanced

booster with something that already exists would give us 130-metric-ton capability. So that is a critical decision that we have to make, and it's a decision that will bear on the industrial workforce or whatever. Those are important decisions for a lot of different reasons.

When you talked about using collaboration with foreign partners and commercial, that's exactly what we're trying to do. We're going to put a BEAM, which is a Bigelow module, on the International Space Station next year, 2015, to take a look at it. It will be heavily instrumented. We'll see how good it is, can it do what we think it can do.

That will enable Bigelow to have data that he can then take to the marketplace and say, look, I've tested this on the International Space Station. He's had two modules that have been in space for probably 5 years now, but they're uninstrumented. He has no idea, he knows they're there, but that's all he knows.

Mr. ADERHOLT. But on the two ideas I talked about, you said you hoped that there will be commercial support. Is that something you would support?

Mr. BOLDEN. We're doing that. That's not something I "would" support. We are committed to fly a BEAM to the International Space Station. We now have an international partner in the critical path for Orion. The service module is to be developed by the European Space Agency, and they made the decision to partner with Lockheed Martin.

So if you were to talk to anybody today working the Orion program, they would tell you that the contractor for the service module, which is an integral part of an exploration mission. Crews can't survive in Orion to Mars. They need a service module and a habitation module. So the service module, we've already made the commitment. The Europeans are in the critical path. If they don't deliver, we don't go.

I did that to show that I'm serious about depending on international collaboration. There is a price to be paid, as we're finding out right now with our partnership with Roscosmos on the International Space Station, but it's a risk that I think is well worth taking. Because, you know, that's something we don't have to pay for; we don't have to pay for the service module if the Europeans are providing it.

So we're working really hard to get the cost, the total lifecycle cost, for SLS, Orion, and our exploration systems down to something the American taxpayer can afford. I know it may not seem like it at times. I would love to have all the money that Congress can give me, but, as a responsible taxpayer, I don't need it all right now. I need it in increments. And I need it when I need it. I don't need a 130-metric-ton SLS right now. I'd have to put it in the barn somewhere because I don't have an Orion that's ready for it yet.

Mr. ADERHOLT. Thank you.

AERONAUTICS CONTINUED

Mr. WOLF. Thank you, Mr. Aderholt.

I have a couple of other issues, but let me go back to aeronautics. Many large firms prefer to locate their manufacturing enterprises near major R&D sources. As a result, a decreasing—and it is de-

creasing—aeronautics R&D base may help drive companies out of the United States and to a location where aeronautics are, indeed, viewed as a higher priority.

How do the size and rate of growth of your aeronautics program compare to the national aeronautics R&D investments being made by major competitors, China or Brazil? How do we compare to China and Brazil?

Mr. BOLDEN. My answer, Mr. Chairman, is not a NASA answer; my answer is a national answer. There are some things that are critical national capabilities. Hypersonics is an area of fundamental capability that the U.S. leads today, and everybody wants to be as good as we are. I don't need to tell you, China is putting huge amounts of money into sending kids to college and to graduate school and to post-graduate schools to become experts in fundamental hypersonics so that they can catch the United States. That's something that NASA works collaboratively and cooperatively with the Department of Defense.

The Nation needs to decide if hypersonics is important. If it is, then we need to fund it. Right now, the Nation, if you look at NASA's budget, which speaks to Congress and the administration, the combination—I'm not blaming this on anybody—the Nation has not decided that hypersonics is of critical importance.

I think that fundamental rotary-wing aeronautics is of critical importance. Right now, the resident expertise for that is in NASA. But the Nation has not decided that, because they neither fund it in NASA or in DOD.

I don't know whether Governor Thornburgh is still here. He talked about these stovepipes. If we continue to stovepipe between DOD and NASA and the intelligence community, instead of working collaboratively the way that we do so well when allowed to, we are going to lose our lead in fundamental hypersonics and in fundamental rotary-wing research.

That's an issue bigger than me. That is an issue where the Congress and the administration need to put their heads together at some point and say, okay, what's important to this Nation? If you want to call each other names or do whatever we are traditionally doing nowadays, we're going to lose. Because many nations are putting big money into fundamental hypersonics to try to catch up with us.

Mr. WOLF. But NASA has proposed the cancellation of hypersonics.

Mr. BOLDEN. Mr. Chairman, again, budgets are about choices. In order for me to carry out the aeronautics strategic plan the way that it is laid out, where we are being told that that's not our responsibility, and I can't get people to sit down at the table and say this is a critical national responsibility. I know it is.

Mr. WOLF. I understand.

Mr. BOLDEN. But I don't have the power to unilaterally say, okay, I don't care what anybody else says, I'm going to take money from science and put more into aeronautics. I would love to have a \$1 billion aeronautics budget, the way it used to be.

Mr. WOLF. I think the committee has funded aeronautics over—

Mr. BOLDEN. Mr. Chairman, please understand me. I'm not being critical of this committee at all. This committee has continued to fund aeronautics at the level that we request. The person I'm blaming is me.

Mr. WOLF. I think above.

Mr. BOLDEN. Now, if I could find a way—I beg your pardon?

Mr. WOLF. Many years, we have pushed—

Mr. BOLDEN. Oh, no, no. I agree with you. I'm saying, if I could find a place to take the money that I would like for you to put into aeronautics and not decimate technology development, commercial crews, science—it's an issue of there is a very limited amount of money, as you all continue to say all day, and my job is to try to prioritize.

So, for something that is a fundamental national capability, while NASA and the NASA Administrator may feel very strongly about that, it would not be smart for me to get into an argument with the science community by taking money out of science and putting it into aeronautics or taking money out of human spaceflight and putting it into aeronautics.

Mr. WOLF. But it is the national aeronautics agency also. NASA—

Mr. BOLDEN. We don't disagree on anything that's been said, Mr. Chairman.

Mr. CULBERSON. Can I have a follow-up to that, Mr. Chairman?

Mr. WOLF. Sure.

Mr. CULBERSON. To enhance the chairman's question, as he said earlier, just submit a reprogramming request to the chairman. I know he's ready, willing, and able to help you.

Mr. BOLDEN. Mr. Culberson, you know what "reprogramming" means. "Reprogramming" means take money from this stack and put it in that stack.

I don't have another program that I—because of where hypersonics ranks today in our national portfolio, at least what I'm being told, I don't think it would be wise for NASA to take money out of something else that I think and you all think is equally as critical, to put it into hypersonics, when, in fact, it may get cut, either by the Congress or somebody else, because I'm now putting it into something that I didn't ask for before.

I've got to work with you all to determine how we get more money into aeronautics. It's coming out of my budget, okay? This committee is not going to—well, maybe you will. Maybe I should ask and let you go to some other agency and take the money.

Mr. WOLF. The committee has been above NASA on this issue.

Mr. BOLDEN. And—

Mr. WOLF. It also has been above on education. Let me go and—

Mr. BOLDEN. Yeah.

Mr. WOLF [continuing]. Move on. And I think we have to leave the room, maybe, at 1 o'clock. I'm not sure. Maybe we can stay later.

PREMIUM AIR TRAVEL

This is a controversial question on premium air travel. A recent Scripps news article documented what appears to be a massive

overuse of premium air travel at NASA. Examples in the article include the Director of Ames is paying more than \$14,000 for a first-class ticket. We're talking about budget priorities, cutting aeronautics, cutting this while the Director of Ames is paying more than \$14,000 for a first-class ticket that would cost less than \$200 in coach. You, yourself, used a first-class ticket to travel from D.C. to Los Angeles at a cost of \$1,600, when coach fares run, I don't know, \$300, \$400, \$500—

Mr. BOLDEN. Mr. Chairman, I would be very happy to show anyone my travel records. I'm not sure how they got or where they got the data. I don't travel first-class. I do get upgrades because I travel a lot.

I just went to—and the staff can go check this. I just went to, a trip, a 3-day trip, to Australia to celebrate the 50th anniversary of the Deep Space Network, round-trip, coach. Now, because I had half-a-million miles traveling for this country, I was able to use one of my global upgrades, if that's counted somehow as premium travel. So I can't help how it's accounted for.

Mr. WOLF. Well, let me—

Mr. BOLDEN. I don't purchase first—my office doesn't purchase first-class tickets.

[CLERK'S NOTE.—NASA submitted the following clarification for the record:]

PREMIUM AIR TRAVEL

During questioning at the Subcommittee's hearing regarding the NASA FY 2015 budget request, the Chairman referred to a recent press report concerning uses of premium travel and specifically to a specific trip taken by the Administrator. The Administrator responded that he does not travel first class at government expense.

In the data provided by NASA to the reporter regarding Agency travel dating back to 2009, it was noted that the Administrator took a single first-class trip at government expense in 2010 to Los Angeles to deliver a speech in connection with NASA's Summer of Innovation education initiative. This trip was booked and the flight was taken on the same day—and it is quite possible that the only seat available on such short notice was a first-class ticket. Given the Administrator's extensive domestic and international travel, it was an inadvertent oversight that the Administrator did not recall this single trip taken four years ago. This is to clarify, for the record, that the Administrator took a single first-class trip in 2010 to Los Angeles.

Mr. WOLF. Was it accurate in the article that the Director of Ames paid more than \$14,000 for a first-class ticket?

Mr. BOLDEN. I don't—I will take that for the record.

[The information follows:]

PREMIUM AIR TRAVEL

Dr. Worden was on official government travel to several European destinations from March 3–20, 2011, and then to Washington D.C., before returning to his home in California. The final vouchered cost for that entire trip, including six legs of airfare, was \$16,249.25. The information provided in GSA Traveltax incorrectly stated that Dr. Worden's trip from D.C. to San Francisco was \$14,773. However, that is because GSA Traveltax does not itemize travel legs for a ticket purchased, only reporting the full cost of one ticket under the last journey; nor does Traveltax include taxes and travel booking fees in its system. Traveltax also does not account for changes made to a travel itinerary after routing of the initial travel authorization is complete. For example, after his meetings in Europe, Dr. Worden was asked to stop over in Washington D.C. from March 17–20, because the NASA Administrator's office requested that he fill in as a keynote speaker at the Space Technology Association luncheon that week.

With regard to increased ticket prices due to premium travel, Mr. Worden was authorized premium travel costs due to his publicly disclosed medical conditions that previously required two surgeries within 8 months prior to the trip and necessitated a third surgery shortly after his return from the trip. NASA and Federal regulations allow the use of premium fares when the traveler has a medical waiver on file, which Dr. Worden did at the time.

Mr. BOLDEN. If it said that in the report, then the report got that data from somewhere, but because they're wrong about my travel, I don't accept anything about the travel of anybody else in the agency.

Mr. WOLF. Would you look into that?

Mr. BOLDEN. We are looking into it. The IG is looking into it. We have—

Mr. WOLF. I think we want to know.

Mr. BOLDEN. Yeah.

Mr. WOLF. It's also my understanding that NASA has stopped responding to requests from the press regarding upgraded airline tickets for thousands of flights. It was also my understanding that your CFO, Beth Robinson, refused to answer many questions during a recent interview about premium travel upgrades.

Would you have your people just cooperate with the media?

Mr. BOLDEN. I'm not responsible to the media. I am responsible to this committee and the American taxpayer. I don't respond to Scripps or whoever it was that gets the data wrong no matter what I tell them. My people don't have time—

Mr. WOLF. But, Mr. Administrator—

Mr. BOLDEN. I'm just saying, Mr. Chairman, we'll respond to you.

Mr. WOLF [continuing]. Maybe by sitting down—

Mr. BOLDEN. We tried that. It didn't work.

Mr. Chairman, we tried to work with them for months. They have called the homes of my employees. They have done everything. But they don't like the answer they get when they talk to the traveler.

When I started out in the Marine Corps, if you travel more than 9,000 miles, you rated business class and you got a business-class ticket. The limit is now 14,000 hours. It's 9 hours of travel. It's now 14 hours of travel in an effort to save money.

My trip to Sydney, Australia, and back was 14 ½ hours one way and 15 hours the other way, and we got a coach ticket. Now, we rated getting a business ticket by travel regulation, but that's not the way we do it. We don't buy the ticket, by the way. There is a central ticketing authority, CI Travel or something. So I have no idea. Every once in a while, they'll put me in a certain class that I can't even use my upgrade miles. Sometimes you win, sometimes you lose.

I don't think that it's worth the taxpayers' time and effort for me to try to respond to a newspaper person.

Mr. WOLF. Well, you're responding to the committee, with all deference. If the gentleman took a \$14,000 first-class ticket—

Mr. BOLDEN. Oh, I'm going to get that answer, Mr. Chairman. I didn't say that. You asked me why don't I take time to respond to the newsmen from Scripps. Because they don't work for you, and so I don't feel any obligation to respond to them any more than I've already done.

We have responded to them over and over and over again. We tried to correct the record over and over and over again. I can't force them to, write something other than—they wanted an inflammatory article. They got it. They misreported some of my travel. I live with that every day.

OPERATION OF MOFFETT AIRFIELD

Mr. WOLF. Last year, the NASA Inspector General investigated the real property practices that allowed H211, a small company affiliated with Google's executive leadership, to lease hangar space for a number of aircraft at the Ames Research Center—Ames again coming up.

Mr. BOLDEN. Yes, sir.

Mr. WOLF. One of the IG's findings was that this lease was provided to H211 without public notice of the hangar's availability and without any competition, which the IG believed to be lacking in fairness and transparency.

NASA agreed to revise its leasing practices by March 31 to prevent any reoccurrence of this type of circumstance. Have these revisions been completed?

Mr. BOLDEN. Mr. Chairman, we've gone even farther. What we've done is we've tried to divest ourselves out of the operation of Moffett Field, where the hangar is. It's my hope that we can announce that there has been a winner in the competition to take over operation of Moffett Field and everything and still provide access to the airfield for national security needs. Because there is a California Air National Guard unit there in C-130s; there is an Army National Guard unit there in helicopters. They will continue to operate. They won't know that NASA is no longer running that field.

It's taken me 5 years to get here, but we turned it over to GSA, and GSA did an incredible job of running a competition to have someone else run Moffett Field. So you, hopefully, will not get any reports about irregularities at Moffett Field after this year. Because NASA-Ames, NASA-NASA—there will be no NASA involved in the operation of Moffett Field.

So, yes, I have done something, and I hope to be able to announce it publicly soon.

Mr. WOLF. The IG also evaluated H211's receipt of below-market-rate aircraft fuel from the Department of Defense as part of its lease arrangement with Ames and estimated that, due to poor communication between Ames and DOD, H211 received \$3 million to \$5 million worth of fuel benefits to which it was not entitled.

Without dictating a specific approach, the IG recommended that NASA explore possible remedies with H211 in an attempt to rectify this underpayment. What is the status of these events? And have you found the means to get them to refund the benefits?

Mr. BOLDEN. We have been working with the people investigating, but, Mr. Chairman, the underpayment is to the State of California and the taxing authorities there. They paid what was the government price for the gasoline. That was a mistake, and we have rectified that. The loss in revenue—

Mr. WOLF. But how long did that go on?

Mr. BOLDEN. I'm not—I'm not really sure.

Mr. WOLF. I mean, that should bother you.

Mr. BOLDEN. Mr. Chairman, that was a miscommunication between DOD and Ames, and we have rectified that. As I said, again, that practice is no longer there. They now pay commercial rate for fuel.

The recoupment of funds is actually something that the State of California and the local taxing authority will have to do. The U.S. taxpayer did not lose any money, they didn't lose any tax revenue there because it's a—you know. But that's the loss, is tax revenue.

INVENTORY OF IT DEVICES

Mr. WOLF. The OIG recently completed a review of NASA's use of mobile IT devices, including smartphones, tablets, and cell phones. One major finding was that NASA has no accurate inventory for all of its mobile devices, meaning that the agency may be unaware of devices that have gone missing, is paying for services that aren't being used, and may not have installed necessary security software on all active devices.

How did the need for something as fundamental as an inventory of devices go unaddressed at NASA for so long?

Mr. BOLDEN. Mr. Chairman, since I've been the NASA Administrator, we have been looking at all of these issues and we have been trying to rectify them. So what we're doing now is that we are establishing a much more accurate inventory of all the IT devices that we have. Some people are being asked to turn in IT devices if they have multiples that we don't feel are appropriate. All I can tell you about is what our path forward is. We're trying to rectify these problems.

OPERATION OF MOFFETT AIRFIELD, CONTINUED

Mr. WOLF. Well, I think it's shoddily run.

And, also, the staff just said Google won the Moffett Field competition at Ames.

Do you wonder why the American people are losing confidence in the government?

Mr. BOLDEN. Mr. Chairman, the point to Ames is it was a lawful, legal competition run—

Mr. WOLF. If I could reclaim my time—

Mr. BOLDEN [continuing]. By the General Services Administration, not NASA.

Mr. WOLF. Yeah.

Mr. BOLDEN. So if Google—and I don't think it's Google, to be quite honest. I think it is a subsidiary. I think it's—what is it, Space Partners or something like that? Planetary Ventures?

NASA did not run that competition. We got out of it and gave it to the General Services Administration as the Nation's landlord, and GSA ran the competition. It was a legal, open, fair competition, and the winner was the winner. We didn't have anything to do with that.

Mr. WOLF. "Google to Restore Hangar One and Operate Runways at" —

Mr. BOLDEN. To save the American taxpayer \$68 million. Yeah.

Mr. WOLF. I haven't interrupted you—

Mr. BOLDEN. I'm sorry.

Mr. WOLF [continuing]. And so, if I may.

“On Monday, Federal officials announced they had chosen a Google subsidiary to restore the landmark Hangar One at Moffett Field and assume control of the airfield’s two runways.”

I think it borders on being shocking. Getting breaks on aviation fuel, the average company doesn’t get that, the average American citizen doesn’t get that. Getting breaks on hangars, it’s just not appropriate.

Let me move on. We’re going to have other questions for the record.

INFRASTRUCTURE UPGRADE

Mr. WOLF. Let me ask two last questions. Then I’m going to go to Mr. Fattah to see if he has any to close.

Currently, Wallops Island supports 50 percent of all U.S. launches to the International Space Station, yet it has received less than 5 percent of the infrastructure investment that Kennedy Space Center has received from NASA over the last 5 years. For example, KSC has received nearly \$700 million in infrastructure upgrades under the 21st Century Space Launch Complex Program, while Wallops received \$5 million from that program.

It is my understanding that Wallops has a number of urgent needs, including infrastructure upgrades and a need for expanded payload processing facilities, given the increased use of this important NASA range.

Why is there such a large discrepancy in the infrastructure upgrades between KSC and Wallops over the last 5 years? And what are your plans for investing in Wallops?

Mr. BOLDEN. The primary reason is because KSC is a Federal facility, and the money spent down there for the 21st Century Launch Complex is for Launch Complex 39–B, where we intend to launch NASA missions. That is not a commercial launch facility.

The facility at Wallops is a commercial launch facility that belongs to the State of Virginia and is run by MARS, the Mid-Atlantic Regional Spaceport. We entered into a Space Act agreement with them. Orbital Sciences gave them money. That is a State of Virginia enterprise. That’s not a Federal enterprise.

So that’s the primary reason for the difference in the amount of money being spent.

I will say, in order to help MARS be able to launch Antares for Orbital, NASA did, in fact, lend people, expertise, and equipment to try to finish the launch complex at Wallops. That was not something we had to do, because that’s a commercial space venture belonging to the State of Virginia. It’s on Federal land, but it is not a Federal facility. So that’s the big difference.

Mr. WOLF. Do you know how many NASA employees are down there?

Mr. BOLDEN. At Wallops? I’ll take it for the record, sir.

Mr. BOLDEN. But most of them don’t—none of them work on the commercial launch facility. That’s MARS. That’s a State of Virginia facility.

I will take it for the record. I hope I don’t have any NASA employees working on the launch facility there.

[The information follows:]

MID-ATLANTIC REGIONAL SPACEPORT (MARS)

The commercial launch pad at Wallops is operated by the Mid-Atlantic Regional Spaceport, an entity under the Virginia Commercial Spaceflight Authority, and employs about 60 at Wallops. The NASA Wallops Launch Facility or Launch Complex—a Federal facility encompassing NASA's only owned and operated launch range, a range control center, payload processing facility, horizontal integration facility, spacecraft fueling facility, on-site and downrange tracking, telemetry, and command destruct assets, air and maritime surveillance work, safety engineers, security personnel, environmental specialists, and specialists in other pertinent support functions—employs about 270 NASA civil servants and 800 contractor employees. (As an aside, there are about 100 Orbital Sciences Corporation employees at Wallops; with an additional 50 OSC employees during launch operations).

SPACE ACT AGREEMENTS

Mr. WOLF. The fiscal year 2014 House report directs NASA to make Space Act agreements available in an online database, similar to other Federal contracts. The committee direction corrects a longstanding gap in transparency for agency contracts and will go a long way towards ensuring better oversight and accountability.

Is NASA on track to comply with this directive to post information about these agreements, including a description of the signatories, duration, purpose, and dollar value, within 180 days, as directed by—

Mr. BOLDEN. We are in the process of making that happen.

We are starting with funded Space Act agreements. I think the committee's request, if I remember correctly, was about unfunded Space Act agreements and NASA money that went toward those. But we felt that it was more urgent to show the taxpayer where the taxpayer money was going, because funded Space Act agreements are those that we put money into. An unfunded Space Act agreement—and we have probably hundreds of those. All of our Space Act agreements will be in this database that will be available.

Now, what they won't be able to see is they won't have access to some of the details of the agreement itself, either because they're procurement-sensitive or something else. But the basic data that will allow any taxpayer to see where NASA is spending taxpayers' funds should be available on that Web site.

Mr. WOLF. Okay.

Mr. Fattah?

AERONAUTICS, CONTINUED

Mr. FATTAH. Thank you, Mr. Chairman.

Aeronautics, I agree with the chairman, is a very important issue. And the FAA has said that this year has been the safest on record in terms of flights. And a large part of this is because of the over-300-plus improvements to flights directly related to NASA-related research that has been incorporated.

I went out to the Boeing facility in Seattle, in Everett. I saw tens of thousands of Americans there assembling these Dreamliners. And I went to Pratt & Whitney in East Hartford, where they make these PurePower engines. All of these private companies have benefited from your research and has provided for the companies not only a way towards more excellent air travel but has provided a level of safety for our constituents.

And NASA is often not credited with all of the great work you've done in this field, but the science that you've used to help fly airplanes safely, actually, a lot of it shows up in other parts of our lives, in the way our cars are maneuvered and so on. So your research has done a great deal, and I want to commend you.

And the chairman asked about your travel. I want the record to be clear. You said you don't travel first-class. I also want the record to be clear that, in the Congress, Members are allowed to use upgrades because of the repetitiveness of travel.

Mr. BOLDEN. I've actually—

Mr. FATAH. And if I was going to Australia, which—I was invited to Australia 2 weeks ago to get an award. I told the chairman at a public event I would much rather get an award with him here rather than fly for 20 hours out to Australia.

But the point is that I don't want—I want you to be credited with the great work that's been done in aeronautics that's been funded by this subcommittee, under the chairman's leadership. And it's literally saved lives and made people's circumstances to be more efficient in their travel.

And I thank you for your appearance today.

Mr. BOLDEN. Thank you very much, sir.

Mr. WOLF. Thank you for your testimony.

With that, the committee will be adjourned.

Mr. BOLDEN. Thank you very much, sir.

Mr. WOLF. Thank you for your testimony.

The Honorable Frank R. Wolf
Chairman, Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on National Aeronautics and Space Administration FY 2015 Budget Request
Witness: Administrator Charles F. Bolden, Jr.

Question 1: The Asteroid Redirect Mission (ARM) concept was originally outlined in a study conducted for JPL by the Keck Institute. That study estimated that the ARM mission would cost \$2.6 billion on top of the costs of getting astronauts to the captured asteroid. Has NASA done an updated estimate of the costs of executing the ARM?

Answer 1: NASA's budget had \$105 million for activities that would also contribute to the Asteroid Redirect Mission (ARM) in FY 2014, and the request for FY 2015 is \$133 million. NASA is refining cost estimates for ARM, and based on progress to date, the NASA Associate Administrator stated verbally that NASA expects the ARM to be achievable within half the Keck concept estimate, not including launch vehicle or mission operations. The specific level beyond ongoing activities and into the outyears is to be requested as part of the FY 2016 budget process and is pending the inputs to the ARM Broad Agency Announcement and work toward mission concept review. It should be noted that most ARM funding will support multiple objectives – not just ARM itself (e.g., funding for advanced solar electric propulsion and automated rendezvous and docking systems).

Question 2: NASA says that much of what it has requested in fiscal years 2014 and 2015 for the ARM will fund activities that are also needed for missions other than asteroid retrieval. Solar electric propulsion, for example, may ultimately be useful for a variety of different government and commercial space projects. How much of the fiscal year 2015 ARM request is for activities that are solely applicable to the asteroid mission?

Answer 2: Many key technologies and subsystems to be developed for ARM have multiple uses, including advanced solar electric propulsion technologies, automated rendezvous and docking sensors, and any investments in robotics. NASA envisions that the robotic spacecraft bus will be used, potentially through simple block upgrades, for future Mars cargo missions and the Broad Agency Announcement currently open requested concepts to support such a block upgrade approach. NASA estimates that virtually all of the content of the \$133M request in FY 2015 could potentially be applicable to future missions through this block upgrade approach. NASA will have greater clarity in mission specific costs after the ARM robotic mission concept review, targeted for February 2015.

Question 3: How does asteroid retrieval advance us toward the eventual achievement of a Mars mission? What specific technologies will be developed or lessons learned from the ARM that are required capabilities for a Mars mission? Could we get those same technologies and lessons from a mission to the moon instead?

Answer 3: ARM integrates a variety of technologies and capabilities important to future crewed missions to Mars and other deep-space destinations. This includes high power, long-life solar

electric propulsion (SEP) technology development, which has future science mission, commercial, and human exploration applications. The application of advanced SEP for asteroid redirection will demonstrate the applicability of this class of SEP technology for moving large objects in space, such as cargo for a Mars mission.

The crewed mission to a redirected asteroid would enhance current test objectives for early flights of SLS and Orion to provide important additional experience beyond low Earth orbit toward the ultimate goal of a crewed mission to Mars. Flight operations for rendezvous, docking, and the integrated Orion-SEP vehicle stack in the lunar distant retrograde orbit (DRO) will provide important learning on this integrated vehicle class in interplanetary-like orbits and environments. Extravehicular activities (EVAs, or spacewalks) by astronauts to sample the asteroid will further this experience for the transit to and from Mars.

This mission prepares us for future long-duration deep-space missions, but also exploits the near-term learning opportunities in the lunar vicinity with limited return-to-Earth capabilities and minimal communications delays. Lunar distant retrograde orbits offer an ideal proving ground for initial crewed operations; however, operations will take place in regions in which returns to Earth are impossible for many days. The round-trip missions to an asteroid will include highly limited resources and no ability to immediately return/abort to Earth. Interactions with an asteroid in lunar distant retrograde region will allow NASA to test and gain operational experience in proximity operations and rendezvous with a non-cooperative target, astronaut experience in complex spacewalks, and sample collection, handling and return. This also provides NASA valuable experience practicing aborts and contingency procedures needed for operations outside the Earth's gravity well, and handling maintenance and repair, including with spacewalks.

In addition, 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 ISS. 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. The radiation environment here is scalable to that expected for astronauts and spacecraft in deep-space journeys such as one to Mars.

Given that the entry, descent, and landing, and ascent environment for Mars is so different from that of the Moon, a costly human landing on the lunar surface would provide limited applicability to a landing on Mars.

ARM is a cost effective mission in the mid-2020s, which complements well the learning on the International Space Station and the SMD Mars Exploration Program to enable NASA to retire significant risk in preparation for future Mars missions.

Question 4: To what extent does NASA take into account the interests and perspectives of its international and commercial partners when setting its exploration roadmap? What have you heard from your partners about what exploration missions they would like to see NASA pursue?

Answer 4: NASA is implementing an integrated human and robotic exploration strategy to achieve long-term human exploration of our solar system, including the goal of human missions to Mars. This strategy was developed in close coordination with our international partners and leverages spaceflight capabilities provided by NASA, international space agencies and commercial partners. NASA has partnered with U.S. commercial entities to transport cargo, and soon crew, affordably to low-Earth orbit (LEO) and has focused International Space Station (ISS) operations and research to enable the development of a demand-driven commercial research market. In addition, as a foundation for international exploration partnerships, NASA and our ISS partners are fully utilizing the research and technology development capabilities of the ISS and exploring future partnership opportunities based on the successful Station partnership model.

The dedicated NASA-industry and international team is making excellent progress toward developing the SLS, which will be evolvable to provide progressively greater lift capability, and Orion, which will enable mankind to successfully navigate the proving ground of deep space, ultimately sending humans to a variety of destinations in the solar system, including Mars. NASA will also employ SLS and Orion for the Asteroid Redirect Mission (ARM) – an early human exploration mission to perform pioneering human operations further from the Earth than ever before, rendezvousing with a robotically-redirectioned small asteroid in a lunar orbit. The ARM mission integrates a variety of technologies and capabilities important to future crewed missions to Mars and other deep space destinations. It also allows for, among other advancements, preparation for supporting potential lunar activities of our commercial or international partners.

NASA's exploration strategy is consistent with the Global Exploration Roadmap (GER), released in August 2013 by 11 of our international space agency partners and NASA in the International Space Exploration Coordination Group. The GER helps demonstrate how NASA's ARM and SLS/Orion test milestones are important development steps toward achieving our goal of future missions to Mars in partnership with the international space agencies. The GER also reflects that NASA and our international partners share a common interest in advancing a unified strategy toward deep-space exploration, with robotic and human missions to destinations that include near-Earth asteroids, the Moon and Mars. Utilizing the key capabilities of SLS and Orion, along with robotic missions, this roadmap builds on our collective successes to date, highlights many exploration preparatory activities underway around the world that will drive innovation and new technologies, and encourages collaboration and integration between human and robotic exploration to return great benefit to the global community.

Question 5: One notable commercial interest, Inspiration Mars, has recently touted the idea of NASA pursuing a Mars fly-by mission in the 2021 timeframe. Is that idea feasible from a technical and budgetary standpoint? Is it feasible from a safety perspective, given that Orion and the Space Launch System will have only completed test flights up to that point?

Answer 5: NASA has had conversations with Inspiration Mars to learn about their efforts and will continue discussions with them to see how the Agency might collaborate on mutually-beneficial activities that could complement NASA's human spaceflight, space technology and

Mars exploration plans. Inspiration Mars' proposed schedule is a significant challenge due to life support systems, space radiation response, habitats, and the human psychology of being in a small spacecraft for over 500 days. The Agency is willing to share technical and programmatic expertise with Inspiration Mars, but is unable to commit to sharing expenses with them. However, we remain open to further collaboration as their proposal and plans for a later mission develop. NASA would not be interested in funding a 2021 Mars flyby mission because it would not be technically feasible for the agency to develop such a mission in a way that would meet safety standards by 2021, and the mission would not be an effective way of furthering NASA's long-term exploration goals.

Question 6: The budget request for the Space Launch System is once again well below both the levels appropriated by Congress and the levels contained in the SLS Independent Cost Assessment. As a result, the request seems to require a launch delay for the first SLS test flight, which is projected to move from December 2017 to the more general "fiscal year 2018." Is that a correct interpretation of your request?

Answer 6: The SLS program continues to work toward a launch readiness date of December 2017. The President's FY 2015 Budget Request provides the funding level needed to keep Space Launch System (SLS) on track to achieve first flight in FY 2018. SLS, Orion, and EGS continue to progress through key flight tests and hardware development milestones, based on FY 2014 appropriations, toward Exploration Mission-1 (EM-1). SLS, Orion, and EGS will each hold key milestone reviews in 2014-2015; the outcome of these reviews will yield a clearer picture of schedule challenges associated with actual technical progress and anticipated funding levels.

Question 7: If your budget request isn't sufficient to keep the first SLS test flight on its original schedule, it seems unlikely that it would be sufficient to also support longer term activities needed for the SLS to evolve to its full operating capability in a timely manner. Is that correct?

Answer 7: At the level of the FY 2015 President's Budget Request, NASA will continue selected, long-lead activities aimed at SLS evolution in parallel with achieving the first flight of the 70-metric-ton capability in FY 2018.

Question 8: This month SLS is expected to complete NASA's Key Decision Point-C (KDP-C), at which time the Agency will lock in a lifecycle cost estimate and an official year-to-year budget baseline for the program. This information is obviously highly relevant to your SLS budget request. Will you be providing this information to the Committee as soon as it is available?

Answer 8: NASA will provide the SLS lifecycle cost estimate and budget baseline to achieve the initial 70-metric-ton lift capability to the Committee after the conclusion of Key Decision Point-C (KDP-C).

Question 9: Is it possible that the lifecycle cost estimate and budget profile agreed to as part of KDP-C will change your SLS request for fiscal year 2015? Or has the team been told to assume that the fiscal year 2015 level is already fixed?

Answer 9: The assumptions supporting SLS KDP-C are based on the FY 2015 funding level requested in the President's Budget.

Question 10: Up until now, NASA has required the SLS program to assume a flat-line budget in all outyears. This is an unnatural and inefficient approach for a major development project that has inherent peaks and valleys. Will the budget profile agreed to at KDP-C also require the assumption of a flat SLS topline, or will it allow natural variation from year to year when needed?

Answer 10: Please see response to Question #8, above.

Question 11: GAO has expressed concerns with the quality of the budget baselines and lifecycle cost estimates that NASA is preparing for both SLS and the Orion Multi-Purpose Crew Vehicle. Specifically, GAO believes these estimates should be prepared so as to show the total development costs needed to get to a full operational capability, whereas NASA is currently planning to calculate costs only through the completion of an initial operating capability. How do you respond?

Answer 11: Orion and SLS are designed to be part of an evolving set of capabilities for deep-space exploration. The Space Launch System (SLS) will transport Orion, as well as cargo and other systems, with a range of lift capabilities from 70 metric tons, evolving to 105 metric tons and eventually up to 130 metric tons, based on future mission requirements. The SLS will ultimately be able to send payloads totaling 38 metric tons into deep-space trajectories. NASA is currently reviewing different component configurations and phasing plans that will enable this capability. While the different versions of SLS will employ some of the same hardware (e.g., the Core Stage), the flexibility of this approach means that different mission sets will become available at different times. NASA has chosen to focus its life-cycle cost estimates on the initial operational capability of Orion/SLS; this will encompass both Orion's development cost, and that of the SLS variant supporting early missions – including the crewed ARM mission. NASA will provide the Congress with insight into the costs of block upgrades of SLS and Orion beyond their initial capabilities as the plans for those are adopted. In this way, the total cost of SLS and Orion will be apparent to the Congress for each stage of evolution.

Question 12: Keeping the International Space Station (ISS) operational for an additional four years through 2024 would likely cost about \$12 billion, using the current ISS annual budget as a guide. What will we have to give up, budget-wise, in order to afford these previously unplanned costs? Do you believe that NASA can afford to continue the Station while simultaneously executing a deep space exploration program and maintaining its commitments to research in Earth and space science and aeronautics?

Answer 12: NASA's human exploration strategy should be seen as an integrated approach to sending astronauts farther and farther into the solar system and enabling them to operate with increasing independence of Earth. In order to support human expeditions into deep space, we must first use the unique environment of International Space Station (ISS) to conduct the research and technology demonstrations necessary to keep our crews safe and productive on

long-duration spaceflights. The research we will conduct on ISS through 2024 will be essential to the safe and effective conduct of human exploration beyond low Earth orbit. The Human Exploration and Operations Mission Directorate will work in cooperation with other NASA Mission Directorates to better understand exploration destinations and improve our ability to work there so that we can move outward to deep space with Orion and SLS. With the technologies and techniques we develop, we will enable expeditions to multiple destinations, ultimately allowing us to pioneer Mars and other destinations as we lay the groundwork for permanent human settlements in the solar system. Commercial LEO development, spurred in part by the continuation of ISS, will also help enable exploration and free resources for deeper space exploration.

Question 13: NASA projects the costs of running the ISS—including operations support and crew and cargo transportation—to continue to rise every year through the budget runout period. These rising costs will be a major challenge to the sustainability of the Station. Do you believe there are realistic opportunities to significantly reduce Station operations costs going forward? How would you do so?

Answer 13: About half of ISS operations costs are in commercial crew and cargo transportation (transitioning from payments to Russia for seats on Soyuz to one or more U.S. Commercial Crew providers beginning by the end of 2017). The ISS Operations and Maintenance (O&M) budget for FY 2011 through FY 2014 has been reduced by over \$1 billion total between the FY 2011 President's Budget Request (when ISS was extended to 2020) and the FY 2015 President's Budget Request, largely due to content reductions. Ongoing activities to responsibly lower the O&M cost of the ISS include changes to contracts to incentivize efficiency, lower overhead cost, and targeted enhancements in technology investments to reduce manpower-intensive processes. These activities have already been assumed in the FY 2015 President's budget request.

Question 14: NASA has told us that sequestration and other reductions in fiscal years 2013 and 2014 required the deletion of 3 planned cargo flights to the ISS between 2015 and 2019. Is your fiscal year 2015 ISS request sufficient to prevent the deletion of additional flights?

Answer 14: The FY 2015 President's budget was formulated prior to receipt of the FY 2014 Appropriations bill. NASA is currently updating cargo requirements as part of the FY 2016 budget planning process, and assessing the full impacts of the FY 2014 appropriations. This may result in an additional flight deletion.

Question 15: NASA is projecting a small decrease in fiscal year 2015 for ISS research (including the research funded directly by the ISS program, most of the research funded by other NASA programs and the research funded by other Federal agencies). Will this decrease in funding cause a commensurate decrease in scientific utilization rates? If the ISS is such an attractive research laboratory, why aren't other programs and agencies increasing their investments in Station research?

Answer 15: While there is a small decrease in FY 2015 for ISS research, it represents a significant increase over the research funding expected in the FY 2014 President's Budget. As

ISS continues to expand its research capabilities, we expect other organizations, internal and external to NASA, to continue to increase utilization of ISS. The current occupancy rate for the U.S. internal facilities is 80 percent. The Principal Investigator community engaged in conducting NASA research to support future human missions into deep-space is expanding. Outside interest in using ISS is increasing, as well: proposal numbers in response to CASIS RFPs continue to grow. The most recent request for ISS experiments resulted in a record response, 2.5 times larger than the largest previous response to a CASIS solicitation. The most recent request for proposals for Earth observations activities in the CASIS solicitation produced a response over twice as large as the response to the previous solicitation in the same area last year. In addition, NASA Earth Science allows ISS proposals under its Research Opportunities in Space and Earth Sciences (ROSES) solicitation. Resource requests for external activities are also growing, and international partners continue to seek opportunities to cooperate to maximize the return on their ISS resources. Interested parties include other Government agencies – such as NIH – as well as commercial entities, working through CASIS. The new capability to perform rodent research aboard ISS is of interest to the pharmaceutical industry for the development of new drugs and treatments.

Question 16: As you know, the Congress has asked NASA to push its industry partners to invest more of their own money into their commercial crew development efforts. This will give the partners a greater stake in the success or failure of their vehicles and provide a more equitable division of responsibility between government and industry in this ostensibly “commercial” effort. How is NASA incentivizing increased private investment for the next round of commercial crew awards?

Answer 16: 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. Competition is the fundamental basis for establishing fair and reasonable pricing for all requirements. Continued competition both incentivizes companies to expand their commercial customer base by selling services to others and takes 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 crew transportation system. Having industry share in the cost of development and selling seats to non-NASA customers will likely decrease NASA’s costs for crew transportation services in both the short and long-term.

A competitive environment provides strong incentives for the companies to make the investments needed to align their commercial offerings with NASA’s certification requirements. These requirements will ensure that the selected contractor/s develop a safe, certified commercial approach to flying NASA’s astronauts as well as other possible customers. Additionally, assured access to space is greatly enhanced by continued competition because if one provider is unavailable, an alternate U.S. source will be available.

Competition will only be effective if there are solid proposals from multiple offerors and sufficient funding to support carrying more than one development activity. The basic proposals must represent a safe and reasonable design approaches. The first phase of the contract was extremely important and allowed NASA to see the basic approaches to certification and verification proposed by the offerors.

Question 17: At the Committee's request, GAO has been monitoring progress on the James Webb Space Telescope and providing findings and recommendations to NASA and the Congress. While NASA has been generally accepting of GAO's advice, there is one major recommendation that the agency does not accept: that NASA perform an updated integrated cost and schedule risk analysis, primarily due to shortcomings in the schedule that was used to produce the initial analysis. Why won't NASA address this recommendation?

Answer 17: NASA did address this recommendation in our response to the GAO report from 2012. In our response we noted:

To ensure the ongoing viability of the Project's plan, NASA performs monthly integrated programmatic and cost/schedule risk analyses through its assessments and updates of the Project's risks, costs and schedule to reflect actual progress and changes to-date. For example, JWST conducts ongoing risk management by identifying risks, assigning probability to the risks, and determining a dollar value of each risk; assesses encumbrances/liens/threats against its Unallocated Future Expenses (UFE); tracks actual costs against planned costs to assess the viability of current estimates; uses earned value management, including independent estimates at complete that are factored into cost estimates; and performs schedule analyses. NASA uses these tools and methods to conduct ongoing programmatic assessment of projects after the baseline is established using the JCL methodology at KDP-C.

Joint Confidence Levels (JCL's) are a valuable tool at the point in a program when one is establishing a baseline, which for NASA missions is at Key Decision Point-C (KDP-C). As described above, once the baseline is established, NASA uses a wide cadre of tools to conduct programmatic assessments. For example, NASA performs monthly integrated programmatic and cost and schedule analyses and updates the Project's risks, costs and schedule to reflect actual progress and changes to date. JWST conducts ongoing risk management by identifying risks, assigning probability to the risks and determining a dollar value of each risk; assesses encumbrances/liens/threats against its Unallocated Future Expenses (UFE); tracks actual costs against planned costs to assess the viability of current estimates; uses Earned Value Management (EVM) reporting systems, including independent estimates-at-complete that are factored into costs estimates; and performs regular schedule analyses. These rigorous systems and procedures have allowed the JWST team to stay within the cost and schedule guidelines set down as part of the 2011 replan for over three years.

This year, at the recommendation of the GAO, we are performing additional schedule risk analyses on three project elements: Integrated Science Instrument Module (due April 2014), Optical Telescope Assembly (due July 2014) and the Mid-Infrared Instrument cryocooler (due September 2014). The combination of these analyses will be informative and actionable and will provide a more useful set of analyses than a one-time statistical validation of plans.

Since its 2011 replan, the JWST program has remained within the guidelines (cost and schedule) of the JCL through rigorous and regular integrated cost and schedule analyses.

Question 18: For a program as expensive, lengthy and complex as James Webb, why wouldn't you want a new integrated cost and schedule risk analysis that reflects not only better schedule assumptions but also all of the lessons learned in the 3 years that have passed since the original analysis was conducted?

Answer 18: See answer to question 17. We continually evaluate our cost, schedule, and technical risks as part of our ongoing integrated programmatic assessment. The original analysis (JCL) is maintained as the baseline to provide a reference to track performance.

Question 19: In the outyear projections accompanying your budget request, the savings associated with gradually decreasing James Webb requirements have all been reallocated into the Astrophysics budget line. Does that reflect a conscious decision by NASA to reinvest Webb savings into Astrophysics, or is it merely a temporary place to show the newly available funds before final decisions are made?

Answer 19: As noted throughout NASA's budget materials, outyear funding levels are notional; however, they do reflect the funding levels that the Astrophysics Division is using for future planning. It is worth noting that the funding for the James Webb Space Telescope (JWST) originally came out of the Astrophysics Division funding line. Keeping NASA Astrophysics (including JWST) at the funding levels identified in the President's FY 2015 budget request is necessary to maintain NASA's world-class Astrophysics program.

Question 20: Two years after drastically scaling back its role in the European Space Agency's ExoMars mission, NASA is now proposing to end its support for SOFIA, a joint activity with the German Aerospace Center (DLR). The Chairman of the DLR called the proposal a "major blow" to his agency's relationship with NASA and implied that NASA is now viewed as an unreliable partner. How do you respond? Are you finding that other countries are becoming less willing to work with NASA?

Answer 20: NASA has a long history of very successful cooperation with nations around the world, and a part of that history has from time to time included some decisions by NASA and some by our international partners to re-phase, redesign or even terminate planned cooperative activities. Even the most robust space partnerships, such as those among the International Space Station partners, have weathered such developments. Our partners are very aware that in all instances our cooperation is based on the availability of appropriated funds, just as we are aware that their participation has similar funding constraints. Now that two-thirds of all of NASA's space and Earth science flight missions involve international cooperation, it is sometimes impossible to avoid impacts to NASA's partners.

Other countries continue to work with NASA on a wide variety of international partnerships and we have not noticed any change in their willingness to work with us. Currently, NASA has over 600 active agreements with over 120 countries and anticipates that international cooperation will remain a cornerstone of all of its future activities. For example, despite NASA having to scale back the U.S. contribution to ExoMars, our European partners have continued to pursue cooperation on Mars exploration, including Germany for the InSight mission, and have

invited NASA participation in significant European space science missions such as Euclid and the Jupiter ICy moons Explorer (JUICE).

Question 21. NASA is looking for a new partner who could assume its share of SOFIA's costs and potentially allow the project to continue without NASA support. How is the search going? How likely is it that you will find another organization willing to step in and provide the needed funds?

Answer 21: NASA is searching for potential new partners to replace NASA's share of SOFIA operating costs in three ways: 1) contacting international space agencies to identify potential foreign partners; 2) issuing a Request for Information (RFI) and hosting an "Industry Day" to identify potential domestic partners; and, 3) contacting other Federal agencies to identify potential users within the Federal government. In all cases, prospective partners had been asked to contact NASA by May 1, 2014, if they are interested in partnering on SOFIA. So far, we have received initial expressions of interest from a small number of potential partners, most of whom have requested additional time to evaluate their level of interest; NASA will work with these groups to see if any viable partnership negotiations are possible.

Question 22: While SOFIA has certain fixed costs for flight crews and maintenance, it also has the ability to scale its budget up or down based on the number of flight hours actually used. Did you consider the possibility of retaining SOFIA with fewer flights rather than outright termination of your support.

Answer 22: Yes. Cost reduction options, including reducing flight hours, result in significant loss of "science per dollar" because a larger fraction of the science is lost than cost reductions are realized. This is just another way of saying that there is a large fixed infrastructure cost for operating SOFIA, and that reduction in marginal costs all comes out of science productivity.

Question 23: NASA's budget request consolidates nearly all agency education activities into the Office of Education with the notable exception of activities funded by the Science Mission Directorate (SMD) and the Space Technology Mission Directorate (STMD). Why have these programs been treated differently than the education and public outreach activities of the other directorates?

Answer 23: The request aligns with the principles of the Administration's FY 2015 STEM proposal and the Five-Year Federal STEM Education Strategic Plan.

NASA requested funding in the Science and Space Technology Mission Directorates because it recognized that the SMD and STMD activities require unique technical assets managed by those Directorates. In the case of STMD, the purpose of awarding STMD fellowships is to provide a mechanism for NASA to utilize relevant early stage technology developed by graduate-level researchers. Space Technology does not conduct these research fellowships with the intent to support workforce development (for the Agency or otherwise) or to supplement the Agency's STEM education portfolio. The unique strength of SMD's education program (which has been in place for over 20 years) is the strong linkage between scientists and educators who infuse the scientific discoveries made possible by our flight programs into educational materials and

curricula. Given this, the Office of Education is further removed from the science content than are SMD scientists and engineers conducting the missions.

The Office of Education request continues NASA efforts to reduce program fragmentation and focuses on areas defined in the 5-year Federal STEM Strategic Plan: STEM instruction and learning; Youth and public engagement in STEM; Enhancing STEM experience of undergraduates; STEM learning opportunities to groups historically underrepresented in STEM fields; and graduate education.

Question 24: Within SMD, NASA has historically allocated 1 percent of each program's budget to education and public outreach activities. This year, all SMD education funds are requested in a single pool with little to no description provided for how the funds will be allocated. What process will you use to distribute these funds in fiscal year 2015? Who will decide which activities will receive funds?

Answer 24: SMD's intention is to allocate appropriated funds competitively by one or more solicitations. In doing so, we will attempt to optimize three objectives: (1) employ the unique strength of SMD's education program, which is the strong linkage between scientists and the discoveries made possible by our flight programs; (2) enhance and clarify the linkage between our education activities and the goals of the Co-STEM report; and, (3) increase the effectiveness of our overall education program by supporting a lean and well-focused integration function between our missions in different science themes and the needs and structure of the educator community.

At present, we are reorganizing our education and communications functions in SMD to further increase their efficiency, and their already high level of connectedness to NASA's Office of Education and interagency education entities.

Question 25: The total request for NASA education programs agency-wide is a fairly large reduction from previous years. How much of this reduction can be achieved through efficiency gains resulting from reduced program fragmentation and how much will represent a real reduction in educational activities?

Answer 25: Notwithstanding any efficiency gained through any reductions in NASA STEM program fragmentation there also will be a real reduction in educational activities. The requested level for the Office of Education, as with other parts of NASA, reflects the Administration's effort to prioritize within the tight discretionary spending caps set by law.

The FY 2015 Budget reduces funding for the Space Grant program. Given that there will be no reduction in the number (52) of Consortia funded, the request represents a real reduction in program activity.

The FY 2015 budget request emphasizes competition and funds only the most meritorious of NASA's historic education investments regardless of original funder, i.e., the Office of Education, Aeronautics Research, Human Exploration and Operations, or Mission Support Directorates. This means that no baseline funding is provided for specific projects previously

funded by the mission directorates and that previously funded activities may be discontinued if they are not selected for funding in the competitive process. NASA will strive to minimize disruption to stakeholders (including individual students) who competed and were awarded in prior fiscal years.

SMD expects to accommodate the reduction between FY 2013 and FY 2015 in its budget for EPO activities principally by two means. First, SMD expects to permanently discontinue some lower priority mission-related activities already occasioned by the FY 2014 budget, while consolidating ongoing higher priority efforts at the division/science theme level. Secondly, SMD is going to review the cross-SMD coordination functions performed by SMD's education Forums to assess the best mechanisms for executing a vigorous and more sharply focused program, consistent with Co-STEM goals, and that is expected to improve the quality and high impact program of previous fiscal years.

Question 26: Last year the National Academy of Sciences released a report on the Experimental Program to Stimulate Competitive Research (EPSCoR) that found, in part, that NASA may not need a discrete EPSCoR program in order to meet its mandates under the law. Did you give consideration to this finding when putting together your budget request? Do you believe it would be possible for NASA to meet EPSCoR's goals through its other Education programs rather than the maintaining a dedicated EPSCoR funding stream?

Answer 26: The America COMPETES Reauthorization Act of 2010 requires NASA to work closely with the EPSCoR Interagency Coordinating Committee (EICC) to implement the recommendations of the National Academy of Sciences (NAS) November 2013 report. Neither the report nor its authors in briefings to the EICC made NASA-specific suggestions, i.e., the Agency has no unique legal mandate to conduct EPSCoR. NASA EPSCoR's legal mandate is through H.R. 6135 (Public Law 102-588), Title III, Sec. 304 (a). NASA EPSCoR provides funding to enable eligible jurisdictions (currently 27 states, Puerto Rico and the Virgin Islands) to develop an academic enterprise in aerospace and aerospace-related research. EPSCoR at NASA awards competitive grants for: 1) Research Infrastructure Development (RID); and, 2) research in areas of strategic importance to the NASA mission.

NASA considered each of the NAS report's seven administrative recommendations that were addressed to all agencies with EPSCoR. NASA's FY 2015 request referenced the NAS EPSCoR report in its narrative. As a practical matter NASA's implementation already closely aligns with the NAS recommendations, so the requested FY 2015 amount reflects NASA's considerations of both the report and commitments to current awardees. Therefore, it is not possible meet EPSCoR's goals through the remaining Office of Education efforts: 1) the National Space Grant College and Fellowship Project, 2) the Minority University Research Education Project (MUREP); and, 2) the STEM Education and Accountability Projects. For example, MUREP provides financial assistance (grants and cooperative agreements) only to the Nation's Historically Black Colleges and Universities, Hispanic Serving Institutions, Asian American and Native American Pacific Islander-Serving Institutions (AANAPISIs), Tribal Colleges and Universities and eligible community colleges as required by the four Minority Serving Institutions (MSI) Executive Orders. EPSCoR is open to non-MSIs such as state colleges and

universities. If there is no dedicated FY 2015 funding, about 100 EPSCoR grants could not continue.

Question 27: The budget request finally contains funding for the pre-formulation of an Outer Planets mission to Europa, which was a recommendation of the most recent decadal survey. It appears, however, that NASA is considering a fairly radical way of pursuing this mission by looking at limiting its costs to \$1B or less. Do you believe it's possible for such a cost-constrained mission to achieve the science goals laid out for Europa in the planetary science decadal survey? If it's possible, is it likely enough to justify spending several months examining this option?

Answer 27: Europa exploration has consistently been rated as among the highest priority scientific pursuits for NASA because it addresses the fundamental question of life beyond Earth. The 2011 Planetary Science Decadal Survey identified the Jupiter Europa Orbiter (JEO) as one of the two highest priority missions of the planetary science community. However, the projected cost of the JEO mission (\$4.7B in FY 2015\$) led the Survey authors to recommend major cost reductions before the mission was undertaken. In response to this recommendation, NASA has considered a variety of Europa mission alternatives with a range of decreased costs. These options included lander, orbiter, and flyby concepts. NASA is currently conducting pre-formulation activities on the Europa flyby concept; an independent Mission Concept Review for this concept is planned for Fall 2014.

At the same time, to ensure that NASA takes advantage of any novel ideas for a reduced-cost Europa mission, NASA is exploring options for a Europa mission that costs \$1 billion or less. It issued a Request for Information (RFI) to the science community in the late April 2014 timeframe. Within the RFI, NASA seeks information regarding low-cost mission concepts (less than \$1B, excluding the launch vehicle) for Europa exploration; as a requirement, the submitted concepts must address the majority of science priorities within the Decadal Survey. Given the potential cost savings, NASA does believe it is worth spending the time to evaluate possible Europa mission alternatives. Progress on pre-formulation activities for the current flyby mission concept will not be impacted by this RFI evaluation, but any future decision on how to proceed with a Europa mission will benefit from any good ideas that emerge.

Question 28: Is there any scenario where you would approve a smaller Europa mission that did not meet the vast majority of the science goals laid out in the decadal survey?

Answer 28: As mentioned in our response to question #27, the RFI that NASA issued regarding low-cost Europa mission concepts requires that submitted concepts must address the majority of science priorities within the Decadal Survey.

Question 29: The OIG recently completed a review of NASA's use of mobile IT devices, including smartphones, tablets and cell phones. One major finding was that NASA has no accurate inventory of all of its mobile devices, meaning that the agency may be unaware of devices that have gone missing; is paying for services that aren't being used; and may not have installed necessary security software on all active devices. When do you anticipate that you will have a complete, accurate inventory of all mobile devices?

Answer 29: In NASA's response to the OIG report, "Review of NASA's Agency Consolidated End-User Services (ACES) Contract (IG-14-013)" dated January 30, 2014, NASA plans to have a Mobile Device Management (MDM) system implemented by August 31, 2014. All mobile devices accessing NASA IT resources and information will be registered in NASA's MDM solution. Following the establishment of the MDM system in August, registration of mobile devices accessing NASA's IT resources will be implemented in 3 phases: ACES-provided devices, non-ACES-provided devices, and employee-provided devices. The MDM phases will be implemented during the FY 2015 timeframe.

NOTE: (ACES – The Agency Consolidated End-user Services (ACES) contract is one of five procurements under NASA's IT Infrastructure Integration Program (I3P). ACES provides a consolidated solution for delivering end-user services across the Agency to achieve increased efficiencies and reduced costs through standardization. Services include: provisioning and support of desktops, laptops, cell phones, personal digital assistants, printers, and office automation software.)

Question 30: Last year NASA said it had installed encryption software on all required agency laptops. Do the findings of the mobile device report cause you to doubt whether your laptop encryption effort was actually completed as promised? Do you think inventory controls on agency laptops are better *than those that exist for smartphones and tablets*?

Answer 30: NASA is committed to implementing the IT encryption and protection program and the NASA leadership is confident these goals will be met. NASA completed the initial "data at rest" encryption effort for all required laptops in June 2013. Because the laptop inventory changes on a daily basis as obsolete computers are replaced, "data at rest" encryption remains an on-going effort to maintain compliance. However, NASA believes sufficient processes and controls are in place to ensure continued compliance with the NASA laptop encryption policy. Inventory controls are equally in place for Agency laptops, smartphones and tablets used across NASA. Relative to laptop inventory controls, NASA procures a majority of its laptop services through the ACES contract, whereby the ACES contractor owns the devices and NASA pays a monthly "seat" charge for the managed services. Therefore, NASA does not maintain the property inventory of the laptops as it does under the NASA property management policies for Government-owned equipment, but instead validates the services received under the ACES contract as part of the monthly invoice reconciliation process, where disputes typically average less than one percent of the invoice value. An initiative is currently underway to further improve the government's record of services ordered and received, which will improve the invoice reconciliation process and accuracy of invoices with an anticipated completion date of November 2014.

Question 31: How long will it take to ensure that you have the appropriate security controls on all mobile devices that connect to the NASA network (including employees' personal devices)? How are you mitigating the risk that will exist in the interim?

Answer 31: As stated in the response to question #29, NASA will implement an MDM solution by August 31, 2014, and will transition all access to NASA resources via mobile devices to that

MDM solution in 3 phases. The completion of those 3 phases is targeted for September 2015. There are numerous efforts currently underway that aim to address the risk of mobile devices connecting to NASA's network. The enforcement of minimum security settings, via Microsoft Exchange ActiveSync, applies numerous security controls on all mobile devices accessing NASA's email system via that method. In addition, the NASA Identity Credential and Access Management team is investigating the use of device authentication through 802.1x certificates, and the NASA Communications Services Office, in collaboration with the IT Security Division, will be deploying network access control (NAC) capabilities as part of its FY 2015 transition roadmap. Each of these efforts will help NASA identify and address the risk from mobile devices connecting to the Agency network space. In the interim NASA has and will continue to develop a number of memoranda and policies aimed at protecting NASA's information systems and resources.

NOTE: (802.1X is an IEEE standard for authenticated network access to wired Ethernet networks and wireless 802.11 networks. IEEE 802.1X enhances security and deployment by providing support for centralized user identification, authentication, dynamic key management, and accounting.)

The Honorable Robert Aderholt
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on National Aeronautics and Space Administration FY 15 Budget Request
Witness: Administrator Charles F. Bolden, Jr.

Question 1: What is NASA's plan for acquiring the large SLS upper stage as required by law to enable a 130 metric ton capability?

Answer 1: The Space Launch System (SLS) will transport Orion, as well as cargo and other systems, with a range of lift capabilities from 70 metric tons, evolving to 105 metric tons and eventually up to 130 metric tons, based on future mission requirements. The SLS will ultimately be able to send payloads totaling 38 metric tons into deep-space trajectories. NASA is evolving from the baseline plan to fly SLS with Advanced Boosters and a combination of the Cryogenic Propulsion Stage (CPS) for ascent, and an Upper Stage for in-space propulsion. NASA is working to implement the Exploration Upper Stage as soon as possible to increase SLS's beyond earth orbit capability. For the Mars missions, SLS will implement Advanced Boosters with the Exploration Upper Stage (EUS) achieving the 130mt capability, which would serve both ascent and in-space functions presently planned for the CPS and Upper Stage. The advantages of the EUS approach would include: simplified architecture; combined functions, greater mission capture, increased payload volume, fewer developments, and potential partner contribution. The development sequence is flexible, and will be informed by mission requirements.

The evolution of the SLS lift capability fulfills specific, important roles within the exploration architecture, with the 130-metric-ton vehicle supporting full capability asteroid missions and ultimately missions to Mars.

Question 2: What is NASA's plan for conducting an advanced booster competition?

Answer 2: NASA's long-term plan for acquiring the 130-metric-ton lift capability relies in part on the need for Advanced Boosters in conjunction with an Exploration Upper Stage. Our current plan for procurement of Advanced Boosters is to do so with an open competition.

Question 3: How does the fact that the Atlas V relies on Russian RD-180 engines affect the commercial crew program in light of ongoing tensions in the region?

Answer 3: NASA is not aware of any effects on the program currently. NASA will monitor developments closely and take actions as warranted.

Question 4: How does the fact that the Antares relies on a booster stage from the Ukraine affect the commercial crew program in light of ongoing tensions in the region?

Answer 4: Antares builder Orbital Sciences is not a current Commercial Crew partner. Thus, NASA is not aware of any effects on the program currently.

Question 5: What are NASA's plans for an actuarial quality study of when CRS commercial cargo costs per pound to orbit will take commercial costs below the cost of cargo launch costs by the previous Space Shuttle, and the past and present Progress, and the European EVA? Please refer to the 2011 House Science Committee hearing charter which showed that the two CRS contracts awarded would not be cheaper than Shuttle costs, even if the contracts were completed on time. If there is no such review planned, I am requesting one.

Answer 5: As NASA has noted previously, there is tremendous variability in the cost-per-pound value depending upon the assumptions used, and the Agency does not regard cost per pound as an appropriate measure of the efficiency of the different modes of transportation. NASA does not purchase cargo transportation on a dollar/pound basis. Cost per 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 FY 2011 cost for cargo transportation using Progress was \$19.6K/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 United States 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 \$19.6K. 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 \$26.9K/pound. NASA has ordered a total of 20 flights on the CRS contracts valued at \$3.5B from FY 2011-2016. 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 \$26.9K. 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 \$39.4K/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 \$3.0B (which reflects the ramp-down of production towards the end of the Program), the cost per pound would be in the range of about \$21.3K/pound to \$51.0K/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/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.

ISS does not purchase H-II Transfer Vehicle (HTV) or Automated Transfer Vehicle (ATV) services; those services are provided via barter agreements.

Question 6: The new NASA reauthorization bill by the house science committee suggests that the James Webb Telescope may not reach completion within the budget caps, which are a part of its program. This program is approaching a contract value of over ten times the original cost. A) Please explain what steps are being taken to direct the contractor to control costs. B) do you recommend a GAO and/or an Inspector General review of these costs? C) please confirm that the Exploration account will not be expected to support these rising costs and that the widely-desired Europa Flagship Mission will not be diminished to support the telescope costs.

Answer 6: The JWST program remains on schedule for launch readiness in October

2018, within the Congressionally-mandated cost cap; the amount of funded schedule slack on the critical path remains 13 months, the same as it was after the replan in 2011. NASA maintains detailed insight and oversight of the contractors supporting the JWST program, and conducts independent analysis of the contractually-required Earned Value Measurement (EVM) data reported by the contractors. This enables NASA to maintain detailed insight into contractor cost and schedule performance, all with the objective of maintaining contractor and overall JWST program development cost within the Congressionally-mandated cost cap. The program and project meet quarterly with executives (VP level) from the major contractors to discuss progress and have a dialog on areas experiencing any difficulty (cost, schedule or technical). Center and HQ personnel involved with the program and project also regularly (weekly to monthly) tag-up with NGAS, Lockheed-Martin and JPL managers on measures of performance.

The reports accompanying annual Congressional appropriations bills in FY 2012, FY 2013, and FY2014 have directed the Government Accountability Office (GAO) to conduct an annual audit of the JWST program, and directed specific areas to be audited, including areas relating to cost. In addition, in response to Congressional direction, NASA provides a quarterly report to Congress on the status of the JWST program. Additionally, Committee staff receive quarterly in-person briefings from program personnel on project progress. Consequently, on the basis of the quarterly reports and briefings to Congress, the annual mandated audit by GAO, and the on-going NASA oversight using a range of tools including EVM analysis, NASA does not believe additional GAO or NASA IG audits are necessary.

As noted above, the JWST program remains on schedule for launch readiness in October 2018, within the Congressionally-mandated cost cap. There have been no rising costs since the replan in 2011. The JWST program has remained within its budget for each of the past three years and there is no forecast for requiring any additional funds.

Question 7: Please report on how conducting at least one SLS launch per year is beneficial in terms of maximizing fixed costs, as well as any other benefits, such as the costs of working with long lead contractors. Outline a plan for planning and executing at least one SLS launch per year starting in 2017, including which launches would carry crew.

Answer 7: In an effort to reduce fixed costs, the SLS Program has worked diligently with industry partners to reduce overhead and right-size design, manufacturing and testing efforts. The Program is phasing long-lead procurements to support the evolutionary development to the launch vehicle and its missions.

The current NASA baseline is for the first launch of the 70 metric ton capability SLS on EM-1 (an uncrewed mission) in FY 2018. The second launch, EM-2 (a crewed mission), is scheduled for FY 2021-2022. SLS is being designed to support an eventual flight rate of 1 per year with a surge capability of 3 per year. The actual cadence of missions beyond 2022 will be defined in the coming months and years based on mission needs and available resources.

Question 8: A recent IG report indicated that one construction project of a tower could, instead, have had its mission-need met by a much more economical upgrade of existing facilities at Marshall. Please comment on which pending new buildings in the NASA budget plan you have reviewed to see if a similar upgrade possibility or expansion of current use, of existing Marshall facilities could be of benefit financially.

Answer 8: The question refers to NASA IG report (IG-14-009, NASA's Decision Process for Conducting Space Launch System Core Stage Testing at Stennis, January 8, 2014) in which NASA's decision was made to conduct the core stage test at the B-2 Test Stand at Stennis Space Center. NASA examined two other possible sites for testing the SLS core stage – the Air Force Research Laboratory's 1-125 1C test stand at Edwards Air Force Base in CA and NASA's Advanced Engine Test Facility 4670 at Marshall Space Flight Center. The NASA IG Report "found that by selecting the B2 NASA may not have chosen the most efficient and cost-effective test site." However, NASA's decision to conduct the core stage test at the B-2 Test Stand at the Stennis Space Center (SSC) was not based on a singular cost factor (i.e. test stand refurbishment), but on a comprehensive assessment set of all risks, including cost and schedule risks to the program and physical risks to valuable flight hardware. Risk avoidance and the ability to test and ship quickly to KSC played a strong role in the final test assignment.

The most economical cost to the government is not the initial cost of the facility, but the life cycle cost of the facility - including design, construction, maintenance and operating cost of the facility over the lifetime of the facility. The risks and operational costs of the program/mission are also taken into consideration. If the facility/infrastructure does not function for the intended purpose, it has failed to support the mission. First and foremost is to know the program requirements (programming), and then to translate these requirements into a successful design/construction project. NASA performs Trade Studies and requires Life Cycle Cost analysis (ECONPACK) on projects to ensure the most beneficial life cycle cost to the government.

The FY 2015 President's Budget includes the following projects at Marshall Space Flight Center, which demonstrate NASA's commitment to evaluate existing infrastructure for upgrade and expansion of use when functionally and economically viable: a \$39.8M Repair-by-Replacement Office (Building 4221); a \$6.0M Revitalize Central Chilled Water Facility Electrical (Bldg. 4473); and, a \$9.4M Revitalize Building Electrical System (Bldg. 4708). Additionally, in the current FY 2014 NASA budget, the Agency is executing the following projects: a \$12.4M Replace Asbestos Siding (Bldg. 4755/4619); a \$7.7M Revitalize Building Mechanical Systems (Bldg. 4755); and, a \$7.3M Revitalize Building Electrical Systems (Bldg. 4619).

Question 9: I am concerned about the delay by Headquarters in communicating with program directors of the Space Grant program nationwide. Claiming "competition" does not address. The holders, and successful executors of, current Space Grants had to compete already; therefore, the Headquarters claim that NASA needs more control is

hard to explain. A) What new criteria is Headquarters trying to impose? B) how are those criteria different from the criteria used to award the current grants? C) please prove that any new criteria for this program will reach as many geographical areas as the current program criteria, including states which are predominantly rural. D) by what date will you communicate application instructions to the current grant holders? E) what is the reason for the delay in the competition of funds held back by NASA?

Answer 9: NASA Headquarters communicates regularly with Space Grant awardees via email, telephone and attended the February 27-March 1, 2014 conference in Arlington, Virginia. The Headquarters program director, however, did miss one Space Grant Directors meeting during the lapse in government funding in October 2013. In FY 2014, Space Grant funding is administered in two-ways: 1) the traditional formula-driven base year awards; and, 2) through a new Cooperative Agreement Notice (CAN) entitled: National Space Grant College and Fellowship Program (Space Grant), Competitive Opportunity for Partnerships with Community Colleges and Technical Schools (2014-2016) (NNH14ZHA003C). The NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) published the competitive CAN on March 20, 2014. Notices of Intent (NOI) to propose were due on April 14, 2014. Full proposals are due on May 28, 2014. Since this is a competition, NASA procurement policies require communication about the CAN be done through written Frequently Asked Question (FAQS) and not personal telephone calls or e-mails with potential proposers. For a copy of the competitive CAN and FAQs that represent communications with the Space Grant community please visit: <http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId={A3C96F5E-3DDF-CAEF-40BF-8C3110D3C90F}&path=open>.

A) The current CAN differs in part from the current 52 base awards, because the competition's scope and criteria incorporate the National Science and Technology Council, "Federal Science, Technology, Engineering, and Mathematics (STEM) Education 5-Year Strategic Plan: A Report from the Committee on STEM Education" (May 2013). This CoSTEM 5-Year Plan did not exist when the current base awards were made. In particular, the FY 2014 competition is shaped by two CoSTEM priority areas: Enhance STEM Experience of Undergraduate Students: Graduate one million students with degrees in STEM fields over the next 10 years". Better Serve Groups Historically Underrepresented in STEM Fields: Increase the number of students from groups that have been underrepresented in STEM fields that graduate with STEM degrees in the next 10 years and improve women's participation in areas of STEM where they are significantly underrepresented.

B) Base award funding is made based on the original proposal submitted and a satisfactory annual progress report provided to NASA by each of the 52 consortia and reviewed and processed on a case-by-case basis. The FY 2014 competition, however, is predicated on recent higher education research findings from the National Research Council and National Academy of Engineering and its report, Community Colleges in the Evolving STEM Education Landscape: Summary of a Summit. Just one excerpt: Community Colleges are an often overlooked but essential component in the U.S. STEM

education system. About 1,200 community colleges in the United States enroll more than 8 million students annually, including 43 percent of U.S. undergraduates (page 1).

The report explains that approximately half of all four-year STEM graduates start their higher education careers at community colleges. As such, Community Colleges and Technical Schools can be a strategic and logical recruitment base for the Space Grant Program. However, for FY 2012 (the most current year data are available) approximately 270 Space Grant Community College and Technical School students (5.8%) received “Direct Funding” in just 21 Space Grant states. During the past 4-years, a total of 24 Space Grant Consortia did not provide any Direct Funding to students at Community Colleges or Technical Schools. (Note: Space Grant “Direct Funding” is defined as “All monetary Student Support” (regardless of the amount of funding). Base awards are not asked to revise their current base proposals. Rather Space Grant consortia are eligible for new two-year awards with a scope different (no overlap) with base awards.

C) All current Space Grant consortia and regions are eligible, including states that are predominantly rural, because all 52 Space Grant consortia are eligible to apply for competitive FY 2014 funds. The competition strategically focuses on a sector of higher education that enrolls much of the future STEM workforce, but has had limited participation in the Space Grant Program. The rationale for focusing on community colleges and technical schools is to enable 2-year-degree-type-granting institutions (they don’t have to have the words “community” or “technical” as part of the institutional name to participate in Space Grant). The competition reserves leadership for the competitive project’s proposal to the leading institution on the current base consortia award.

D) The NASA FY 2015 budget narrative estimates a release of a new call for proposals for base awards at the end of the first quarter of FY 2015 (December 2014), with awards anticipated in the September 2015 timeframe.

E) NASA expects to open the new call for proposals for new base awards in calendar year 2014 and the new 52 base awards will be made using FY 2015 funds. The NASA FY 2015 budget request is for base awards only. For FY 2014 funds, the Space Grant program will work with the NASA Shared Services Center (NSSC) for both base awards and the-to-be-determined number of new competitive awards and estimates FY 2014 funds to the Consortia will be awarded no later than February 2015. Even in the case of base funding, it can take time for the NSSC to actually award the funds because annual progress reports must be complete and pass both technical officer and grant officer review.

Question 10: While collections of new projects have been introduced, most notably the Space Technology account, other work specifically in the Sciences, has remained stagnant or declined. Please comment on your plans for carrying out additional work on gamma rays.

Answer 10: The Astrophysics Division depends on the National Research Council’s Decadal Survey for its science priorities. Every decade, the NRC Decadal Survey sets

the science priorities for the Astrophysics and other science Divisions in the Science Mission Directorate; this includes priorities for work in gamma rays and other wavelengths of light. Work on gamma rays is not a priority for the most recent (2010) Decadal Survey in Astronomy and Astrophysics. The next Decadal Survey will reexamine the priority of work in gamma rays.

Question 11: Please comment on possible self-contradictions in the commercial and cargo programs. The Administration has argued that competition is needed in order to obtain the best value for the taxpayer. This was used to justify investments, which will total several billion dollars out of a very strained NASA budget. These investments do not secure intellectual property for the government (for the taxpayer) other than the first-choice option by NASA to buy what you have already paid for, in the event that a company, which received these dollars, fails. How will you make sure the CRS-2 contract allows entrants to compete in a fair manner, so that we know we are receiving the best price and best reliability?

Answer 11: NASA is in the process of conducting a full and open competition for follow on capability of the Commercial Resupply Services (CRS), referred to as CRS2. NASA is taking every step possible to promote competition. In February 2014, NASA posted a very detailed Request For Information (RFI) synopsis, which set forth requirements NASA is contemplating for resupply of the ISS. The RFI also specifically requested feedback from industry on a wide range of topics, including terms and conditions. NASA then conducted an Industry Day on April 10, with 21 different companies represented in person or via the Internet. NASA conducted one-on-one sessions with 10 companies the following day. As part of the Industry Day kick-off, Administrator Bolden and the ISS Program Manager, Michael Suffredini, spoke to industry and emphasized how critical industry feedback was in order to refine the Agency's requirements and maximize competition. The Agency plans to issue a draft solicitation in May, and a final solicitation in June. The draft solicitation will again provide industry information and opportunity to weigh in on key parameters, including barriers to entering the market, which will help NASA refine the follow on acquisition plan for procuring safe, cost effective, timely, and reliable ISS research and cargo resupply, disposal, and return services.

Question 12: At a cost of many millions of dollars per year, NASA supports the climate model at GISS in NY City. In the latest results of that model, in which 35 different simulations were performed to show global atmospheric temperature changes since 1979 (attached), the model over-warmed the atmosphere in every case by a large amount, not coming close to the real world as observed independently by both satellites and balloons. Since this enterprise has absorbed many millions of dollars per year, yet has provided what appear to be clearly failed results, what type of independent analysis, i.e. outside of the federal government, has been sought to evaluate and understand the significant errors it continues to produce?

Answer 12: NASA procedures and practices provide many opportunities for the independent analysis and evaluation of the NASA GISS model. These procedures do not

reveal that the GISS modeling effort or the GISS model can be considered to be failed; on the contrary, they indicate a vigorous research effort at the forefront of Earth system modeling. These procedures for the robust independent analysis and evaluation of the model and the modeling effort include: 1) The method by which the GISS Earth system modeling group is reviewed; 2) Participation of the GISS model in the internationally organized Coupled Model Intercomparison Project (CMIP) as well as other model intercomparison exercises; 3) Funding of independent research utilizing the GISS Earth system model by the Modeling, Analysis and Prediction program; 4) Easy availability of both model executables and source code, facilitating evaluation by any interested party; and, 5) The standard NASA practice of requiring publication of scientific results in open, peer-reviewed literature.

NASA relies on peer review to evaluate the research efforts that it funds. The NASA GISS modeling effort is required to submit proposals to NASA Headquarters describing its planned model development and research efforts, which are then reviewed and rated by expert panels including unconflicted external reviewers. Recently, a panel consisting of 10 prominent scientists, with 5 university and 4 non-NASA Federal scientists, reviewed the GISS modeling effort. The panel gave high marks to the effort using the criteria of intrinsic merit, relevance to NASA research goals, and cost reasonableness. The GISS modeling effort will continue to be reviewed periodically by this method, to ensure that a high standard is maintained.

NASA also participates heavily in the Coupled Model Intercomparison Project (CMIP) in addition to several other "MIPs." CMIP is an international effort organized under the World Climate Research Program to intercompare climate models with each other and with observations. The latest exercise (CMIP5) involved over 61 climate models from over 24 organizations within at least 11 countries. The effort involved 57 separate experiments testing models against each other, against historical and recent observations, and providing predictions of future climate change. The model output generated in these exercises are intercompared and evaluated against observations by thousands of independent researchers worldwide. CMIP5 investigators have produced at least 565 publications in peer-reviewed journals to date, with many more to come. The NASA GISS modeling effort contributed over 230 separate simulations totaling about 46 TB of model output. NASA's involvement in this exercise provides the opportunity for any interested researcher to evaluate GISS model output relative to the world's best climate models and against observations as well. Currently, at least 138 publications have been produced that consider GISS climate model contributions to the CMIP5 database. In these publications, the GISS model can compare favorably relative to the other world-class models and can demonstrate excellent agreement with observations. As an example, the degree of agreement with observations for 2 versions of the GISS model are compared with 40 other climate model simulations in Figure 9.7 of the recent International Panel on Climate Change fifth assessment report. The figure shows the error of each of the simulations relative to the others for 13 different observational metrics. The GISS Model E-R error is less than 30 percent in 10 of these 13 comparisons, comparing well with the other models.

In addition to contributing model output to the CMIP exercise, NASA also contributes to CMIP a variety of observations through its “Obs4MIPs” activity. The contributed observational data sets have been formatted to facilitate comparison with the CMIP models, and are made available through the same web portal as the model results. This enhances the capability of any interested independent evaluator of the CMIP models, including the NASA GISS model, as it provides an extensive set of observations upon which to base diagnostic evaluation of model performance.

The NASA Modeling, Analysis, and Prediction program issues periodic research solicitations and funds multiple non-government investigators to conduct Earth system modeling research. The program routinely requests research to evaluate with observations the representation of important Earth system processes within NASA’s Earth system models, one of which is the GISS model. This focus provides NASA-funded external evaluation of the GISS model and leads to improved representativeness of modeled physical processes.

The GISS model (both executable and source code) is made available to interested users, and is extensively documented and discussed at the GISS web site. Thus it is possible for independent investigators to run the model themselves, examine the code for errors, and publish their results in the literature should they think their results sufficiently important.

NASA has a long-standing policy that the results of the scientific investigations it funds be published in peer-reviewed, open literature. The GISS model has been used extensively for a broad variety of investigations, and the GISS team has succeeded in producing hundreds of publications utilizing the model over the years. It is worth noting that each of these many publications has been peer-reviewed. Every time a GISS paper is submitted for publication, the reviewers are chosen by the journal for their expertise and independence from NASA GISS. The reviewers are responsible for evaluating the scientific merit of the results, which includes consideration of the capabilities of the model upon which the results are based. Thus, every publication which is generated by the GISS modeling effort includes independent evaluation of the results and the model upon which it is based.

The Honorable Andy Harris
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on National Aeronautics and Space Administration FY 15 Budget Request
Witness: Administrator Charles F. Bolden, Jr.

Question 1: In the 14 years of the program the federal government as a whole has never met their 3 percent HUBZone goal. How is NASA doing both nationwide and locally on meeting this goal?

Answer 1: In 2013, NASA has had its highest year in HUBZone, awarding 1.17 percent of eligible dollars (\$12.7B) or \$148M as compared to the rest of Government’s 1.75 percent. In Maryland’s 1st Congressional District, NASA has awarded 97.05 percent of the eligible dollars (\$5.9M) to small businesses, although none of these awards was to certified HUBZone companies. These local contracts were awarded by six of the ten NASA Centers, including the Goddard Space Flight Center, Johnson Space Center, Kennedy Space Center, Armstrong Flight Research Center, Langley Research Center, and Marshall Space Flight Center.

NASA is working to meet its HUBZone goal of 3 percent and is holding several Industry Days specifically targeted at HUBZone Small Businesses. In June 2012, an event was held at the Glenn Research Center in Cleveland, OH. The event was well attended by senior NASA officials as well as local government officials and over 300 HUBZone companies. On October 16, 2012, NASA held an Agency-wide HUBZone Industry Day and Expo at the Kennedy Space Center (KSC) in Cape Canaveral, Florida. The event was attended by senior NASA officials, as well as local government officials including the Honorable Bill Posey, U.S. House of Representatives 15th District of Florida. The event attracted over 500 (556) attendees, and 150 exhibitors. Forty-four percent (44 percent) of the exhibitors who responded to the after action survey indicated they had received business as a result of attending this event. In addition, NASA has partnered with the National HUBZone Council and participated at the National HUBZone Conference in Washington, DC in September 2013 and in April at the HUBZone Summit by exhibiting and holding matchmaking sessions. NASA is hosting another Agency-wide HUBZone Industry Day at the Marshall Space Flight Center on June 10, 2014.

Between FY 2012 and FY 2013, NASA has made great strides in its HUBZone dollars and percentages as reflected in the chart below in part due to these efforts

Category	FY09	FY10	FY11	FY12	FY13
Certified HUBZone Small Business Actions	686	1,076	1,102	1,024	879
Certified HUBZone Small Business Dollars	\$108,290,037	\$134,591,630	\$99,453,587	\$93,098,745	\$148,674,088
Certified HUBZone Small Business Percentage	0.74%	0.86%	0.71%	0.69%	1.17%

Question 2: Under the “National Defense Authorization Act for Fiscal Year 2013” government executives are required to promote the achievement of small disadvantaged

business goals. What special steps has NASA taken to reinforce accomplishment of these goals?

Answer 2: NASA has exceeded its SDB goal of 5 percent, every year since 2008 (see the chart below). In Maryland's 1st Congressional District NASA has awarded 75.75 percent of the eligible dollars to SDB using the 8(a) program.

CATEGORY	FY08		FY10		FY11		FY12		FY13	
	GOAL	ACTUAL								
SDB	5.00%	9.06%	5.00%	7.13%	5.00%	7.02%	5.00%	7.65%	5.00%	8.81%

Question 3: Of the 12 counties that I represent in the state of Maryland, 2 full counties are designated as HUBZone areas. Both of those are in close proximity to the NASA facilities (Wallops Island and Goddard). What is NASA doing to promote HUBZone contract awards in Maryland?

Answer 3: NASA Goddard Space Flight Center, (GSFC) in Greenbelt Maryland and Virginia's Wallops Flight Facility (WFF) attended several small business conferences during each FY and conducted matchmaking sessions to assist companies with identifying business opportunities at GSFC and WFF. Through May 2014, GSFC will have attended four conferences to include the U.S. Chamber of Commerce National Small Business Federal Contracting – DC Summit/Nov 2013; U.S. Chamber of Commerce National Small Business Federal Contracting - DC Summit/ March 2014; and the U.S. SBA National Small Business Week – Conference/May 15. Also, NASA had breakout session at the American Council for Technology/Industry Advisory Council (ACT/IAC) Small Business Conference on April 24 to discuss target areas that are most relevant to doing business in the Agency; one of which is HUBZone.

NASA GSFC also plans to utilize the NASA Vendor Database (NVDB) to aggressively identify HUBZone companies interested in doing business with GSFC on upcoming opportunities and to encourage these companies to respond to Sources Sought Synopsis (SSS).

Question 4: What are the impediments to meeting the HUBZone prime contracting goals? Is contract size an issue? Is finding qualified vendors an issue? What is NASA doing to achieve the HUBZone goals with the identified impediments? Does NASA have a plan to meet the HUBZone prime contracting goals?

Answer 4: Most of what NASA buys is in the high-tech arena and there are a limited number of HUBZone concerns in this field; NASA is making a concentrated effort to develop them through the Mentor Protégé Program (MP). The MP program partners small businesses with large NASA prime contractors to mentor them in technical and business skills. In addition, part of the acquisition planning process is to issue a sources sought synopsis (SSS) in order to conduct market research. The SSS specifically states "NASA is seeking capability statement from all interested parties, including Small, Small Disadvantage (SDB), 8(a), Woman-owned (WOSB), Veteran Owned (VOSB), Service Disabled Veteran Owned (SD-VOSB), Historically Underutilized Business Zone (HUBZone businesses, and Historically Black Colleges and Universities (HBCU)

Minority Institutions (MI) for the purposes of determining the appropriate level of completion and/or small business subcontracting goals for this requirement." Unfortunately, responses from HUBZone companies are very limited or non-existent. The limited responses received from the HUBZone companies are often determined not to be capable of meeting the requirements. NASA continuously reviews requirements to explore break-out opportunities for HUBZone concerns. The plan forward, in addition to the specially targeted HUBZone Industry Days, is for NASA to identify North American Industry Classification System, (NAICS) with the registered HUBZone companies in the (NVDB) to ensure they receive notice of all NASA contracting opportunities. The objective is to solicit responses from a sufficient number of qualified HUBZone companies to consider a HUBZone set-aside competition. Although a HUBZone set-aside does not allow NASA to restrict the procurement to a specific geographical area. Lastly, NASA has provided the Small Business Administration a corrective action report detailing these efforts in meeting its HUBZone goals in the future.

The Honorable John Carter
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on National Aeronautics and Space Administration FY 15 Budget Request
Witness: Administrator Charles F. Bolden, Jr.

Question 1: The Voyager probes continue their amazing and profound missions into deep space. How stable is the hardware and software here on earth that extracts data from these probes? Are there failsafe mechanisms or backups in the event of system failure here on earth? Is NASA ensuring that technicians and scientists on the ground are trained so we can continue to receive and interpret data from Voyager for as long as we can?

Answer 1: All of NASA's science missions, including the Voyager 1 & 2 spacecraft, are in good hands. NASA's Deep Space Network (DSN) has been providing daily communications support to Voyager 1 and Voyager 2 since they launched in 1977, and for numerous other deep space missions since its inception in 1963. The DSN utilizes three complexes (in Goldstone, California; Madrid, Spain; and Canberra, Australia) located approximately 120 degrees apart on Earth to enable continuous sky coverage.

The DSN is managed to provide the best reliability, accuracy and proficiency possible, currently providing better than 99.5 percent proficiency. The Voyager probes do present unique challenges: Voyager 1 is the farthest spacecraft from the Sun, and Voyager 2 is the second farthest operating spacecraft. As these distances continue to increase (Voyager 1 is traveling away from the Sun at 61,100 km/hr and Voyager 2 is traveling at 55,522 km/hr), the DSN has implemented new techniques, such as arraying of antennas and combining of weak signals, which will allow continuing excellent support of the Voyager spacecraft downlinks.

NASA continues to upgrade and enhance the DSN, as required, to maintain its unique capabilities. The Space Communication and Navigation (SCaN) Program within the Human Exploration Mission Directorate (HEOMD), has undertaken a major capacity and capability enhancement activity. The DSN Aperture Enhancement Project (DAEP) began in 2010 with the groundbreaking for the first of three new 34-meter antennas in Canberra, providing additional capabilities and redundancy in case of system failure. NASA's Jet Propulsion Laboratory manages the DSN and will continue to ensure that its technicians are trained to maintain the hardware to receive the data so NASA scientists can interpret and share their discoveries with the world.

NASA recognizes a risk to future communication in that the unique equipment that provides the high power S-band uplink to Voyager is aging and difficult to maintain. As long as these components continue to function, NASA anticipates supporting Voyager until its power levels drop to a point where its instruments can no longer be powered, which is anticipated to be in approximately 2025. At that point, Voyager will have provided almost a half-century of amazing scientific exploration of our solar system and beyond.

Question 2: Voyager’s website states, “We have power to run the spacecraft and all the science instruments until 2020. At that time we start science instrument shutdown and about 2025 the last instrument will be shutdown. An engineering only mission is possible until 2036.” What do you mean by “engineering only mission? What knowledge could we gain through an engineering only mission?

Answer 2: In an engineering only mission that would operate from around 2025-2036, the Voyager spacecraft would still transmit data containing the health of engineering components on the spacecraft, as well as the spacecraft’s location, but would no longer be sending data from its unpowered science instruments. This mission would still be valuable for spacecraft longevity studies, especially by providing data on temperature and usage cycles of individual components from spacecraft beyond the limits of our solar system. Additionally, Voyager’s signal could be used as a test signal for new technology developments and engineering experiments in tracking and telecommunications with the Deep Space Network (DSN). NASA’s Science Mission Directorate periodically conducts comparative reviews of Mission Operations and Data Analysis (MO&DA) programs to maximize the scientific return from these extended missions within limited resources. NASA uses the findings from these comparative reviews to define an implementation strategy and give programmatic direction to the missions and projects concerned for the next two to four fiscal years. Voyager operations are judged in the Heliophysics senior reviews every two years, and the engineering-only mission concept would be subject to a senior review circa 2023 to determine if the data return of the proposed mission concept warrants funding.

Question 3: One of the challenges of a manned mission to Mars is preserving the abilities of a crew to function and coexist peacefully during long-term space travel. What does NASA hope to learn about this with the commencement of the Hawaii Space Exploration Analog and Simulation Mission?

Answer 3: While NASA is not directly utilizing the Hawaii Space Exploration Analog and Simulation (HI-SEAS) facility, the Agency is supporting two research projects – selected from NASA Research Announcement proposals – that use HI-SEAS. These projects are: “Effects of Retronasal Smelling, Variety and Choice on Appetite and Satiety,” from Cornell University; and “Key Contributors to the Maintenance and Regulation of Team Function and Performance on Long Duration Exploration Missions,” from the University of Hawaii.

Question 4: Experiments similar to this, namely Biosphere, showed the challenges of maintaining productive group dynamics in an enclosed environment. Should the Hawaii mission have similar results, would this seriously hamper a manned mission to Mars?

Answer 4: Maintaining productive group dynamics in an enclosed environment will be very important to long-duration missions into deep space. NASA is preparing for such missions through a series of ground-based analogs and through expeditions to the International Space Station (ISS). The ISS offers a unique platform to test future exploration systems and operations because it provides a long-duration, zero-gravity space environment and the opportunity to evaluate many factors not available in other analog missions. NASA will use

the ISS as a test site for long-duration missions to identify the risks and challenges to astronaut health and safety, prepare for crew autonomous operations needed for handling communication time delays, exercise ground elements training and technology development, and evaluate new exploration systems and capabilities as they become available.

Question 5: Last week you shut down all elements of working with Russia, other than the International Space Station. There is a lot of planning and technical interchange between engineers that is not strictly operations, but does affect operations. ISS Operations require a lot of travel to prepare as there is training in both countries. Is this affected?

Answer 5: NASA and Roscosmos, the Russian Federal Space Agency, continue to work together to maintain safe and continuous operation of the International Space Station, where humans have lived continuously for more than 13 years as well as certain other activities conducted with Russia. This includes operations, planning, training, travel and utilization activities. Ongoing ISS work with Roscosmos includes the May 28, 2014 launch of a Soyuz spacecraft, which carried a U.S. astronaut, a Russian cosmonaut, and a German astronaut representing the European Space Agency to ISS.

Question 6: We have astronauts and flight controllers that spend months in Russia. If these are affected it could cause harm and safety issues with regards to operations. Can you comment on this?

Answer 6: NASA and Roscosmos, the Russian Federal Space Agency, continue to work together to maintain safe and continuous operation of the International Space Station, where humans have lived continuously for more than 13 years as well as certain other activities conducted with Russia. This includes operations, planning, training, travel and utilization activities. Ongoing ISS work with Roscosmos includes the May 28, 2014 launch of a Soyuz spacecraft, which carried a U.S. astronaut, a Russian cosmonaut, and a German astronaut representing the European Space Agency to ISS.

Question 7: I have not heard of other agencies that work as closely with Russia taking measures to this degree. What other agencies have taken similar actions?

Answer 7: Given Russia's ongoing violation of Ukraine's sovereignty and territorial integrity, the U.S. government has taken a number of actions, to include curtailing official government-to-government contacts and meetings with the Russian Federation on a case-by-case basis. For actions other agencies have taken, we refer you to those agencies, the State Department or the National Security Council staff.

Question 8: While you state that ISS won't be affected, how do you know that Russian won't retaliate because of NASA's actions?

Answer 8: The success of the ISS program is based on the mutual dependence of all partners and clearly recognizes the unique contributions they each provide to the program. As such, it is in the interest of all ISS partners to continue our normal operational and programmatic cooperation

and not to allow disruption of any of the activities that have maintained continuous human presence on orbit for over a decade.

Question 9: Do we ever allow Russians to have full control over the International Space Station? It is my understanding we have done so when Johnson Space Center was shut down for hurricanes.

Answer 9: The ISS can be commanded through both the U.S. and Russian Mission Control Centers, and critical systems that are required to maintain a stable orbit – such as guidance, navigation and control, and communications – are multi-failure tolerant and have dissimilar redundancy across the U.S. and Russian elements.

NASA's Marshall Space Flight Center (MSFC) Payload Operations Center (POC) has coordinated scientific research carried out aboard the International Space Station (ISS) since 2001. The POC also acts as a Backup Control Center for Mission Control Center – Houston (MCC-H) in the event of a catastrophic event. While this is primarily a hurricane season (June to November) contingency, the POC can be activated in the event of the unanticipated and immediate loss of capability at MCC-H.

Question 10: Because of the current crisis, does NASA have plans to curtail any Russian access or controls of ISS?

Answer 10: NASA and Roscosmos, the Russian Federal Space Agency, continue to work together to maintain safe and continuous operation of the International Space Station, where humans have lived continuously for more than 13 years as well as certain other activities conducted with Russia. This includes operations, planning, training, travel and utilization activities. Ongoing ISS work with Roscosmos includes the May 28, 2014 launch of a Soyuz spacecraft, which carried a U.S. astronaut, a Russian cosmonaut, and a German astronaut representing the European Space Agency to ISS.

Question 11: Do you have any fear that Russia could commandeer control of ISS if relations become more intense?

Answer 11: The success of the ISS program is based on the mutual dependence of all partners and clearly recognizes the unique contributions they each provide to the program. As such, it is in the interest of all ISS partners to continue our normal operational and programmatic cooperation and not to allow disruption of any of the activities that have maintained continuous human presence on orbit for over a decade. If the current situation deteriorates such that there are indications that the ISS partnership might be affected, contingency planning by NASA related to the space station must maintain the safety of the vehicle and of all crewmembers including Russian, American and other international partner astronauts.

Question 12: Why does NASA allocate part of its ISS research budget line item to multi user system and support rather than biological and physical sciences? Does this limit funds that go to actual research?

Answer 12: Multi-user Systems Support (MUSS) is the infrastructure to support all research on ISS, both NASA and National Laboratory research. It funds the development, operations, and maintenance of all multi-user hardware and research facilities on ISS. It also funds planning and payload operations support to bring research to ISS and provide results to scientists. It supports activities on ISS funded by Biological and Physical Sciences, the Human Research Program, Advanced Exploration Systems, Space Technology Mission Directorate, and the Science Mission Directorate. Biological and Physical Sciences research activities support NASA research announcements and development, operations, and maintenance of unique hardware to support those investigations. It also funds the Center for the Advancement of Science in Space (CASIS), the non-profit organization that manages the National Laboratory aspects of the ISS. The MUSS and the Biological and Physical Sciences projects work closely together to ensure that the capabilities on ISS are in place to support planned research and to expand utilization of ISS. The MUSS budget has historically been reported as part of ISS Research.

Question 13: I'm pleased that NASA and the USAF partner to track space debris that could harm the ISS. What is the time lag between when the USAF notices troubling debris and when NASA is alerted? How much lead does the ISS need to prepare for incoming debris?

Answer 13: DOD's Joint Space Operations Center (JSpOC) is responsible for performing conjunction assessments for all designated NASA space assets (including the ISS) in accordance with an established schedule (every eight hours for human spaceflight vehicles and daily Monday through Friday for robotic vehicles). JSpOC notifies NASA of conjunctions which meet established criteria.

NASA has a set of long-standing guidelines that are used to assess whether the threat of such a close pass is sufficient to warrant evasive action or other precautions to ensure the safety of the ISS crew. When predictions indicate that the debris will pass close enough for concern and the quality of the tracking data is deemed sufficiently accurate, Mission Control centers in Houston and Moscow work together to develop a prudent course of action.

Sometimes these encounters are known well in advance and there is time to move the Station slightly, known as a "debris avoidance maneuver." Other times, the tracking data isn't precise enough to warrant such a maneuver or the close pass isn't identified in time to make the maneuver. In those cases, the control centers may agree that the best course of action is to move the crew into the Soyuz spacecraft that are used to transport humans to and from the Station. This allows enough time to isolate those spaceships from the Station by closing hatches in the event of a damaging collision. The crew would be able to leave the Station if the collision caused a loss of pressure in the life-supporting module or damaged critical components. The Soyuz spacecraft act as lifeboats for crew members in the event of an emergency.

Debris avoidance maneuvers are usually small and occur from one to several hours before the time of the conjunction. Debris avoidance maneuvers with the ISS used to require about 30 hours to plan and execute mainly due to the need to use the Station's Russian thrusters, or the propulsion systems on one of the docked Russian or European spacecraft. A "pre-determined" debris avoidance maneuver capability, developed and tested in 2012, allows debris avoidance maneuvers to be planned and executed in as little as 3 hours.

For further information on this topic, please see:

http://www.nasa.gov/mission_pages/station/news/orbital_debris.html

Question 14: As the Commercial Crew Program moves into its next and final development phase, please describe how NASA plans to continue maximizing competition and utilizing commercial approaches to safely fly our Astronauts and protect the taxpayer.

Answer 14: 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. Competition is the fundamental basis for establishing fair and reasonable pricing for all requirements. Continued competition both incentivizes companies to expand their commercial customer base by selling services to others and takes 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 crew transportation system. Having industry share in the cost of development and selling seats to non-NASA customers will likely decrease NASA's costs for crew transportation services in both the short and long-term.

A competitive environment provides strong incentives for the companies to make the investments needed to align their commercial offerings with NASA's certification requirements. These requirements will ensure that the selected contractor/s develop a safe, certified commercial approach to flying NASA's astronauts as well as other possible customers. Additionally, assured access to space is greatly enhanced by continued competition because if one provider is unavailable, an alternate U.S. source will be available.

Competition will only be effective if there are solid proposals from multiple offerors and sufficient funding to support carrying more than one development activity. The basic proposals must represent a safe and reasonable design approaches. The first phase of the contract was extremely important and allowed NASA to see the basic approaches to certification and verification proposed by the offerors.

Question 15: How much funding have the three commercial crew competitors contributed towards their vehicles and this program? How much funding have you provided these commercial providers?

Answer 15: By the time the Commercial Crew Integrated Capability (CCiCap) is completed, NASA's investment in the three rounds of Commercial Crew Space Act Agreements (CCDev, CCDev2, and CCiCap) will be \$1.533 billion. Based on representations by the companies, our industry partners will have made an aggregate investment of approximately 20 percent. The actual aggregate investment of the partners may be higher to the extent that industry has absorbed cost growth associated with hardware development challenges and schedule delays.

NASA has also provided \$29M to industry for the Certification Products Contracts. The corresponding partner investment is unknown, but the partners almost certainly contributed to this activity, as the generation of these products has proven to be even more significant than we

or they anticipated.

Question 16: Who owns the vehicle if a company is eliminated from the commercial crew competition, and are taxpayer funds recouped?

Answer 16: NASA has determined that title to all tangible property acquired by the participant under the Commercial Crew Development (CCDev), and Commercial Crew Integrated Capability (CCiCap) agreements will remain with the partners. The purpose of a funded Space Act Agreement (SAA) 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. Under these SAAs, NASA only pays the participant when milestones are achieved.

Under a FAR-based contract for the provision of commercial crew transportation services to and from the ISS, NASA would be procuring services, not hardware; the spacecraft itself would remain the property of the contractor. As was the case with the SAAs noted above, NASA would be paying the commercial partner incrementally, based on milestones achieved.

Question 17: Ideally, competition reduces the costs. Yet we've seen no sign of that in the commercial crew program, and if anything, the opposite has occurred. Why is this so expensive and is there a market for this besides ISS transportation?

Answer 17: NASA believes the Commercial Crew Program will be very cost effective, especially in comparison to previous human spaceflight programs. NASA's assessment of the market for human space transportation is contained in the "Commercial Market Assessment for Crew and Cargo Systems, pursuant to Section 403 of the NASA Authorization Act of 2010 (P.L. 111-267)" dated April 27, 2011.

Question 18: If increased funding is needed for Commercial Crew to accelerate the program, why aren't you also requesting the same for Orion and the Space Launch System?

Answer 18: The President's FY 2015 Budget Request provides the funding level needed to keep Space Launch System (SLS) on track to achieve first flight in FY 2018. It builds on work this year to carry out the first flight test of Orion, which will travel farther into space than any human spacecraft has gone in more than 40 years.

SLS, Orion, and EGS continue to progress through key flight tests and hardware development milestones, based on FY 2014 appropriations, toward Exploration Mission-1 (EM-1). SLS, Orion, and EGS will each hold key milestone reviews in 2014-2015; the outcome of these reviews will yield a clearer picture of schedule challenges associated with actual technical progress and anticipated funding levels.

The Honorable Mario Diaz-Balart
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on National Aeronautics and Space Administration FY 15 Budget Request
Witness: Administrator Charles F. Bolden, Jr.

Question 1: Russia suffered two launch failures in last year due to engine and quality control issues in their manufacturing base. A U.S. alternative to the Russians is even more critical given the growing costs of the Soyuz spacecraft, and Russian launch issues. Isn't it imperative that the U.S. expedite the development of U.S. commercial crew capabilities to eliminate this sole-source dependency on Russia, particularly given the current political situation? How does the budget request seek to end unnecessary reliance on Russia?

Answer 1: NASA will complete a commercial crew competition this summer, and if Congress fully funds the President's FY 2015 Budget Request, the Agency can stay on track to launch astronauts to the International Space Station (ISS) from American soil by the end of 2017. This capability is critically important to safe/sustained Station operations, and will end our sole reliance on our Russian partners for this service. The requested funding is required to meet this critical near-term need.

Question 2: Since the retirement of the Space Shuttle in 2011, the U.S. has sole-sourced human spaceflight to Russia and is now paying the Russians more than \$70M a seat to fly U.S. astronauts. Russia has continually increased their prices for astronaut rides to the International Space Station, from \$48M per seat in 2007 to \$70M in 2016—an increase of 46 percent in under 10 years. By 2017, NASA will have spent nearly \$2.7B purchasing astronaut transportation from Russia. In January, NASA announced that U.S. astronauts will continue to fly to and from the International Space Station (ISS) aboard the Russian Soyuz (soy-use) through the end of 2017, though no costs were publicly released. NASA plans to reserve 6 seats during 2017. Can you tell this committee what the costs are for these 6 seats? Has the recent political situation in Ukraine factored into the Russia's prices for the transportation? With NASA having our best and brightest, shouldn't you have enough data to identify the safest and most reliable vehicle to transport our astronauts to ISS and rid ourselves of Russian dependency?

Answer 2: In April 2014, NASA contracted with the Russian Federal Space Agency (Roscosmos) on a sole-source basis for six Soyuz seats and associated services for calendar year 2017 with rescue and return services extending through spring 2018 via contract modification. The procurement of Soyuz seats requires an advance commitment of approximately three years to allow for the lead-time of vehicle production. Services include launch, return and rescue of U.S. or U.S.-designated astronauts and associated services. The full value of this contract extension is \$457,969,488 for six seats, including all necessary training and preparation for launch, launch site support, flight operations, landing and crew rescue for a long-duration mission as well as some limited crew cargo delivery to and from the Station. The average price per seat is approximately \$76M, an increase of ~ 8 percent from the Soyuz services contract modification signed last year. This percentage increase is comparable with previous Soyuz services contract modifications.

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 sole reliance on foreign providers and bringing that work back home. NASA continues to work with its commercial partners to develop a U.S. commercial capability for human spaceflight and plans to launch American astronauts from U.S. soil by the end of 2017. This will be a pivotal year for NASA's Commercial Crew Program (CCP) as the Agency is on track to award one or more development and certification contracts by August/September for the Commercial Crew Transportation Capability (CCtCap) phase that would lead to operational crewed flights to the ISS. Through the successful execution of this program, we will return to the United States the vital capability to launch astronauts to the ISS from U.S. soil and return them to Earth.

The Honorable Mike Honda
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on National Aeronautics and Space Administration FY 15 Budget Request
Witness: Administrator Charles F. Bolden, Jr.

Question 1: The process that NASA followed in its decision to deprioritize and defund the Stratospheric Observatory for Infrared Astronomy (SOFIA) in the President's FY 2015 proposed budget troubles me, and I have several questions about it. In your testimony, you said that SOFIA was selected as a low priority project by a scientific review process. Please clarify what scientific evaluation process was undertaken. What group of scientists was involved? What were they tasked with? Who did they report to? Was this an external or internal committee? Also, please provide a copy of documentation from this scientific review of the SOFIA program.

Answer 1: The 1990 decadal survey performed by the astrophysics community ranked SOFIA as the community's third most important medium-sized project for the ten years to follow. The decision to propose, as part of the FY 2015 NASA budget request, to put SOFIA into storage was primarily a budgetary decision driven by the tight budget caps in the Bipartisan Budget Act of 2013. SOFIA's scientific priority relative to other projects within NASA's Astrophysics portfolio was a secondary consideration to accommodating the level of NASA's FY 2015 Astrophysics budget request (\$607 million) compared with the FY 2014 appropriated level (\$668 million). Among the possible Astrophysics projects considered for reduction, SOFIA was identified for two reasons. First, it is the only strategic Astrophysics project that was not a first priority of a Decadal Survey. Second, while it was a priority in the 1990 Decadal Survey as a medium-class mission, its operations costs are the second largest of all NASA science missions, with only Hubble costing more.

Question 2: Typically, science programs are reviewed by a formal Senior Review to decide when to deprioritize and potentially reduce funding for/phase out a project. It appears that this was not done for SOFIA. Why was a Senior Review not performed on SOFIA? Why was it recommended to defund SOFIA without such a rigorous scientific Senior Review process?

Answer 2: With the successful commissioning of its fourth science instrument in February 2014, SOFIA entered its operations phase in May 2014. Senior Reviews are reviews of the science productivity of operating missions to support an assessment, based on demonstrated science accomplishments, of the anticipated science value of an extended mission. At this point SOFIA has not established a baseline of science accomplishments sufficient to serve as the basis for a Senior Review

Question 3: In an April 8, 2014 letter to the NASA Advisory Council's Science Committee, its Astrophysics Subcommittee wrote "*The decision to greatly reduce funding for the Stratospheric Observatory for Infrared Astronomy (SOFIA) in FY15, and*

discontinue funding in FY16 and beyond, is of deep concern to the APS for several reasons. The decision to terminate a working \$1B observatory only two weeks into its prime mission is unprecedented. The APS recognizes that budgets fluctuate and decisions are required to adapt to changing funding realities. However, decisions of this magnitude made without community input undermine the manner in which NASA and its stakeholders have worked effectively for so many years. The APS is concerned about the opaque process followed in the case of SOFIA and stresses the importance of following the well-established, community-input based process of the Senior Review in evaluation of missions.” Why was the NASA Advisory Council (particularly the subcommittee for astrophysics) not involved in the process to review SOFIA’s science mission before NASA decided to deprioritize it and defund it? These NACs were established to provide NASA with guidance on science issues and yet NASA has cut a \$1.2 billion project without consultation.

Answer 3: SOFIA’s high operating cost was a primary factor in the FY 2015 Budget proposal to put SOFIA in storage, unless alternative funding sources are found. While significant funding has been spent to develop SOFIA, this funding is less than half of the estimated \$3B life-cycle cost of the program.

The formulation of the Administration’s budget request to Congress is an embargoed process that is conducted by members of the Executive Branch; as such, public commentary cannot be a component of the process.

Question 4: The NAC APS’s letter goes on to read: *“The APS is greatly concerned with the repercussions that the termination will have with respect to our credibility with one of NASA’s most important collaborators. SOFIA is a joint project involving the US and Germany (80%, 20%, respectively). Ending the mission barely before science operations carries the double negative of denying Germany any significant development savings while providing no return on their investment. Germany was not consulted regarding the decision to end US funding and the Deutsches Zentrum für Luftund Raumfahrt (DLR) has clearly made its displeasure known. APS is concerned that the damage caused by the unilateral US decision could jeopardize German collaborations with NASA on a host of current and future missions and will undermine the confidence of our current and future international partners on other missions.”* When were the German partners at DLR first notified of NASA’s plans to defund SOFIA? You mentioned that alternative funding sources for SOFIA are being sought – please provide an update on this effort. Has DLR shown interest in becoming a larger partner on the project? What effects would a decision like this have on NASA’s future ability to form partnerships with other space programs when NASA is willing to abandon our German partners so abruptly by unilaterally deciding to end funding for SOFIA operations?

Answer 4: Our German partners at DLR were first notified on February 28, 2014, of NASA’s plans regarding SOFIA. DLR has informed NASA that they have no interest in becoming a larger partner on the project. NASA is searching for potential new partners to replace NASA’s share of SOFIA operating costs in three ways: 1) contacting international space agencies to identify potential foreign partners; 2) issuing a Request for

Information (RFI) and hosting an "Industry Day" to identify potential domestic partners; and, 3) contacting other Federal agencies to identify potential users within the Federal government. In all cases, prospective partners had been asked to contact NASA by May 1, 2014, if they are interested in partnering on SOFIA. So far, we have received initial expressions of interest from a small number of potential partners, most of whom have requested additional time to evaluate their level of interest; NASA will work with these groups to see if any viable partnership negotiations are possible.

NASA has a long history of very successful cooperation with nations around the world, and a part of that history has from time to time included some decisions by NASA and some by our international partners to re-phase, redesign or even terminate planned cooperative activities. Even the most robust space partnerships, such as those among the International Space Station partners, have weathered such developments. Our partners are very aware that in all instances our cooperation is based on the availability of appropriated funds, just as we are aware that their participation has similar funding constraints. Now that two-thirds of all of NASA's space and Earth science flight missions involve international cooperation, it is sometimes impossible to avoid impacts to NASA's partners. Other countries continue to work with NASA on a wide variety of international partnerships and we have not noticed any change in their willingness to work with us.

Question 5: In your testimony, you stated that "we continue to operate SOFIA by the original 2014 plan," yet I have recently learned that plans may be underway to begin shutting SOFIA down prior to Congress acting on the FY2015 budget request. Has a modified Operating Plan been submitted for FY2014 that would begin the SOFIA shutdown, or is one in the works? I trust that NASA will not take any unilateral action until Congress acts on this year's budget request. This includes the essential maintenance for the 747 aircraft housing SOFIA scheduled for May 2014. Will NASA proceed with the planned aircraft maintenance program paid for by our German partners at DLR in May 2014?

Answer 5: NASA will not take any unilateral action without Congressional notification. NASA has not submitted a FY 2014 modified Operating Plan to begin the shutdown process for SOFIA. NASA and DLR will proceed with the SOFIA aircraft maintenance program in late June 2014.

Question 6: In your testimony, you stated that "the Astrophysics community did not have SOFIA ranked high enough in their prioritization that when we had to go through the types of budget exercises leading up to sequester, SOFIA did not make the cut line." What astrophysics community are you speaking of? The NASA Advisory Council was not consulted. The American Astronomical Society (AAS), the major organization of professional astronomers in North America, was not consulted. The AAS put out the following statement days after the President's FY15 budget was released: *"The American Astronomical Society strongly endorses community-based priority setting as a fundamental component in the effective funding, management, and oversight of the federal research enterprise. Broad community input is required in making difficult*

decisions that will be respected by policymakers and stakeholders. The National Academies' decadal surveys are premier examples of setting priorities with extensive community input. Other National Academy studies, senior and portfolio reviews, standing advisory committee studies, town hall meetings, and mid-decade adjustments to the decadal surveys are also important components. These processes leverage the combined effort and expertise of the community to maximize the scientific return of the public and private investments in the astronomical sciences. These community processes are particularly beneficial during times of highly constrained budgets. Efforts that go outside these long-standing advisory processes in an attempt to benefit or harm specific projects or alter priorities are counterproductive and damage the scientific endeavor as a whole." The Decadal Surveys performed by the astrophysics community have repeatedly placed SOFIA at the top of the priority list of projects.

Answer 6: The 1990 decadal survey performed by the astrophysics community ranked SOFIA as the community's third most important medium-sized project for the ten years to follow. Subsequent decadal surveys did not explicitly rank SOFIA, which was already well into implementation by 2000. Constrained by tight spending caps set by law and in light of competing needs in the NASA budget, the Administration's proposed FY 2015 NASA budget request recommends placing the observatory into storage unless alternative funding sources are found.

In determining the portfolio of programs to be funded within the Budget request, Decadal Survey priorities are applied; that is the astrophysics community priorities which were referred to in the hearing.

Question 7: In your testimony, you stated that "SOFIA did not rank high enough on the list of scientific priorities because [...] we do still have sources of getting the data that SOFIA would provide." You alluded to the US operated Spitzer and European operated Herschel space-based observatories still being operational and collecting data in the far infrared. But Spitzer's cryogenics were exhausted in May 2009 and Herschel's cryogenics ran out in April 2013, meaning both of these space-based observatories are no longer able to make observations in the far infrared. Is it not true that SOFIA is our only telescope currently able to make observations in the far infrared? And isn't it true that while the James Webb Space Telescope will be able to observe in the mid infrared wavelengths, it will not be able to observe far infrared light when it is operational in orbit in 2018?

Answer 7: SOFIA's current suite of instruments is optimized to provide imaging and spectroscopic capabilities in the 1-250 micron wavelength range. SOFIA is designed to be synergistic, not redundant, with other infrared missions. For example, at near and mid-infrared wavelengths (0.6-28 microns), the James Webb Space Telescope (JWST) is optimized for very faint targets, a capability that necessitates lower resolution spectroscopy, which will be appropriate for observing distant galaxies. By comparison, SOFIA's high spectral resolution capability over the same wavelength range is the only suitable "tool" currently available to astronomers to study the motions and chemical composition of closer, brighter objects in the Milky Way and nearby galaxies. For example, SOFIA will enable the study of planet forming disks around stars, which

requires extraordinary spectral resolution in order to resolve velocity structure, and study of the chemistry of the interstellar medium, which requires very high spectral resolution to identify new chemical species and distinguish between different chemical species and their isotopic variations. (Unique targets observed by SOFIA, as well as other observatories, can be followed-up by JWST.) SOFIA will also have the unique capability to study magnetic fields at infrared wavelengths, thereby addressing profound questions about the role of magnetic fields in the star formation process. With the recent decommissioning of the Herschel Space Observatory, SOFIA will provide astronomers the only access to the far infrared spectrum (Herschel observed in the 55-672 microns wavelength range), for at least a decade or more based on current development plans for future space missions.

Question 8: If SOFIA is defunded and “mothballed” at the end of 2014, it will represent throwing away a \$1.2B investment by the US taxpayer into a program that was fully operational and making observations for less than 1 year of a proposed 20 year lifespan. As recently as last year’s FY 2014 budget request, NASA was testifying to Congress that SOFIA was an essential program and a critical tool needed for astrophysics research. What statement does this make to our citizens and our international partners that NASA will prioritize and argue for funding for a flagship program for over a decade and then turn around and defund it months after it becomes operational? Do you anticipate this harming NASA’s reputation? Do you feel that NASA’s seeming willingness to defund a flagship program without community input or scientific review will damage NASA’s reputation among astrophysicists in the US and abroad?

Answer 8: NASA is very aware that its budget decisions have major consequences to our science investments and to our domestic and international partners. NASA has to make tough budget decisions in order to maximize the scientific return of the public in the astronomical sciences. The decision to propose, as part of the FY 2015 NASA budget request, to put SOFIA into storage was primarily a budgetary decision. SOFIA’s scientific priority relative to other projects within NASA’s Astrophysics portfolio was a secondary consideration. Any accommodation of the proposed reduction in the NASA Astrophysics budget would have similar implications.

Question 9: Space biological and physical science research has been part of NASA’s portfolio from the beginning. This biological and physical research reveals fundamental knowledge about the role of gravity in biological and physical systems, will be a critical component to surviving the long duration trips to the Moon, Mars, and beyond, and was the original reason the ISS was built. It has had many homes within at NASA: once it was part of the science directorate; once it was its own directorate and now it is in the Human Explorations and Operations directorate embedded in the ISS program. In the ISS program, the “ISS Research” line funding is \$312M yet the majority of this funding is being used by various operational programs. Only 18 percent of the \$312M for “ISS Research” is being used for biological and physical ISS research. Over ten years ago, NASA funded this research at more than \$300M, but today the research is funded at only \$60M even though the ISS has a \$3.0B budget. Why does biological and physical research only receive \$60M in funding, 2 percent of the total ISS budget? Why are other

operational programs for the ISS being allowed to siphon off 83 percent of the funding from the “ISS Research” line, leaving only 18 percent of the \$312M to be used for academic biological and physical research?

Answer 9: The budget for ISS Research, \$312.2 million in the FY 2015 budget request includes three major categories: Multi-User System Support (MUSS), the Non-Profit Organization (NPO), and biological and physical research. Multi-user Systems Support (MUSS) is the infrastructure to support all research on ISS, both NASA and National Laboratory research. It funds the development, operations, and maintenance of all multi-user hardware and research facilities on ISS. It also funds planning and payload operations support to bring research to ISS and provide results to scientists. It supports activities on ISS funded by Biological and Physical Sciences, the Human Research Program, Advanced Exploration Systems, Space Technology Mission Directorate, and the Science Mission Directorate. Biological and Physical Sciences research activities support NASA research announcements and development, operations, and maintenance of unique hardware to support those investigations. It also funds the Center for the Advancement of Science in Space (CASIS), the research management organization for the ISS National Laboratory which enables non-NASA research activities. Exciting research will include potential medicines and interventions that will improve human health both in space and here on Earth. CASIS continues to explore new opportunities to develop new research concepts for the ISS, and to implement a value-driven utilization program that brings new users to the ISS research community. The MUSS and the Biological and Physical Sciences projects work closely together to ensure that the capabilities on ISS are in place to support planned research and to expand utilization of ISS. The MUSS budget has historically been reported as part of ISS Research. The ISS Research budget also supports the In-Space Robotic Servicing activity.

The near term strategic goal of NASA’s ISS Research is to conduct a program of scientific research endorsed by the research community and focused on the accomplishment of outstanding scientific objectives. ISS biological and physical research is dependent on ISS operations for success. The Space Life and Physical Sciences, Research and Applications (SLPSRA) Division has management of biological and physical research and the ISS program has the responsibility for operating the vehicle and managing ISS utilization for NASA and its partners. Retaining the ISS biological and physical research budget within the overall ISS budget is reflective of this symbiotic relationship and supports collaboration between the two offices.

Question 10: NASA has reaped significant benefits from its partnership with private companies in the Commercial Cargo Program. Competition has enabled the development of two new safe launch vehicles and spacecraft for less than the cost of a single Space Shuttle flight. As we look to the next phase of the Commercial Crew Program, how will ongoing competition among providers continue to help the agency achieve sustained lower costs, safety, and assured access to space for our next generation of astronauts?

Answer 10: 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. Competition is the fundamental basis for establishing fair and

reasonable pricing for all requirements. Continued competition both incentivizes companies to expand their commercial customer base by selling services to others and takes 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 crew transportation system. Having industry share in the cost of development and selling seats to non-NASA customers will likely decrease NASA's costs for crew transportation services in both the short and long-term.

A competitive environment provides strong incentives for the companies to make the investments needed to align their commercial offerings with NASA's certification requirements. These requirements will ensure that the selected contractor/s develop a safe, certified commercial approach to flying NASA's astronauts as well as other possible customers. Additionally, assured access to space is greatly enhanced by continued competition because if one provider is unavailable, an alternate U.S. source will be available.

Competition will only be effective if there are solid proposals from multiple offerors and sufficient funding to support carrying more than one development activity. The basic proposals must represent a safe and reasonable design approaches. The first phase of the contract was extremely important and allowed NASA to see the basic approaches to certification and verification proposed by the offerors.

Question 11: What strategic workforce analysis was performed during the FY15 budget formulation process to support NASA's decision to downsize its workforce even faster than existing plan for a 5% reduction over three years? Was any assessment of NASA's critical intellectual capabilities completed to determine the mid-to-long term workforce needs of the Agency as it replaces its aging civil-servant workforce before proposing the accelerated downsizing?

Answer 11: Each year as part of the budget formulation cycle, NASA conducts an assessment of the civil service workforce requirements from individual missions, programs and projects in order to determine the level of civil service workforce that is supported by program content and associated budgets. This assessment is multi-year, covering the out years as well as the budget year. Requirements for civil service are compared to levels of workforce at each Center location, and senior leadership of the Agency determines what is sustainable in terms of workforce levels at each location. Additional civil-service reductions proposed in the FY 2015 President's budget reflect a modest change to in-house resources consistent with programmatic budget reductions, and a need to balance project staffing with procurement budgets necessary to fulfill program and project needs. Civil service levels are reviewed each budget cycle, allowing the Agency to adjust those levels as new information is available. NASA is currently in the process of assessing technical capabilities across all field Centers, and results of this assessment will flow into the upcoming formulation cycles.

Question 12: At some NASA centers, the civil-service workforce is less than a third or even a quarter of the Center workforce (and this does not include the large outside

contracts performing vehicle development). Given the Columbia Accident Investigation Board's admonition about inadequate government technical (and financial) oversight of contractors by federal employees, why is NASA proposing to thin its in-house civil servant expertise even further than it already is?

Answer 12: The ratio of civil-service workforce to contractor workforce varies significantly by Centers, with ratios varying from approximately 1:1 to 1:3 and an average ratio across the Agency of 1:2. Between FY 2010 and FY 2013, civil-service workforce levels at the Agency decreased by 3 percent, whereas contractor workforce levels decreased by 28 percent. Thus, a large majority of the reductions to on- or near-site workforce over the last four years have been made to the contractor versus civil service workforce, with the largest overall reductions to Centers such as Johnson Space Center (JSC), Kennedy Space Center (KSC) and Marshall Space Flight Center (MSFC) reflecting changes to changes the human space flight mission portfolio. Given reductions in budget and associated program content over this period of time, NASA is maintaining a sufficient government footprint to perform inherently governmental functions including oversight of contractors.

Question 13: Over the past decade, the overall Aeronautics mission was shrunk by about two-thirds even though our nation's economic competitiveness in commercial aviation and the imminent transition to a modern next generation airspace system are at critical junctures. In that light, why is NASA seeking to reduce the Aeronautics budget and workforce even further?

Answer 13: NASA concurs that our nation's economic competitiveness in commercial aviation and the imminent transition to a modern next generation airspace system are at critical junctures. Accordingly, NASA has rolled out a new Aeronautics Strategy that will ensure appropriate investment and focus of our activities on six strategic research thrust areas. These six thrusts include: Safe, Efficient Growth in Global Operations; Innovation in Commercial Supersonic Aircraft; Ultra-Efficient Commercial Vehicles; Transition to Low-Carbon Propulsion; Real-Time System-Wide Safety Assurance; and Assured Autonomy for Aviation Transformation. Together, these thrusts are aimed at ensuring future competitiveness of the U.S. aviation industry and the realization of a modern next generation air traffic management system. Aviation Week Magazine writers and editors after hearing the roll-out of this new strategy wrote that "Civil Aviation is blessed with growing demand, record orders and increasing deliveries, but facing global competitors, affordability and sustainability challenges, and an industry-shaking technology revolution." Faced with what the Aviation Week editors called a "Time-Bomb of Complacency," they further wrote that "An alarm needs to be sounded. A vital and vigorous aeronautics research program is essential. ... NASA's unveiling of a new strategy for aeronautics research is a bold and welcome move."

The NASA investment in aeronautics research that supports this competitiveness and the transition to NextGen has been essentially constant from FY 2005 through the budget request for FY 2015. A large portion of the reduction in the Aeronautics budget since FY 2004 is due to NASA's accounting changes and not reductions in technical content. In

FY 2004 the Aeronautics budget included funding for support activities that are now included in the Cross Agency Support budget. Since FY 2007, the Aeronautics budget has been stable with an average appropriation of \$536.5M per year.

The FY 2015 budget request for Aeronautics is \$551.5M and includes funding for 1,250 civil servants. With this budget NASA will continue to develop technologies to address the most pressing needs of the aeronautics community, while working to minimize the environment impacts of aviation. To support this critical work, NASA works with the Research Centers to ensure the availability of world-class resources (including personnel and facilities) and to also ensure that any workforce profile adjustments will not undermine our critical core competencies. NASA recognizes the significant contributions that its aeronautics research makes and will continue to support these activities within the balanced Agency budget and in alignment with all the Agency's priorities.

THURSDAY, MARCH 27, 2014.

NATIONAL SCIENCE FOUNDATION

WITNESS

DR. CORA MARRETT, ACTING DIRECTOR, NATIONAL SCIENCE FOUNDATION

OPENING REMARKS OF CHAIRMAN WOLF AND RANKING MEMBER
FATTAH

Mr. WOLF. Good morning. I want to welcome everyone to today's hearing on the National Science Foundation. Our witness is Dr. Cora Marrett, NSF's deputy director. Dr. Marrett has also served as acting director for the last year and is here today to represent her agency and its new director, who was recently confirmed but is not yet on board. Thank you for being here.

The subcommittee is a big supporter of basic research, which enables innovative discoveries that boost our economy, improve our national security, and answer fundamental questions about the world. As a result, we have worked hard to ensure that NSF receives adequate support even in times of fiscal restraint. In fact, with the exception of fiscal year 2013 when sequestration unfortunately produced across the board reductions, we have increased NSF's research budget every year for the past decade. The administration's request for fiscal year 2015, however, would challenge that trend by proposing small increases only for NSF's STEM education activities and agency management.

The agency's main research account is actually slated to decrease, which would require reductions in nearly all of NSF's priority cross-cutting research programs, including advanced manufacturing, cybersecurity, and cyber infrastructure improvements.

I am anxious to discuss the justification for this request and its likely impacts, as well as a variety of other issues surrounding NSF's budget and the agency's plan for executing and managing its funds.

In a moment we will begin that discussion with some brief opening remarks, but first I want to recognize my good friend, Mr. Fattah.

Mr. Fattah?

Mr. FATTAH. I thank the chairman, and I welcome again the acting director to make her presentation. Rather than prolong it with a speech from me I think I will just agree with everything that the chairman said and we will begin. All right?

Mr. WOLF. Thank you, Mr. Fattah.

Pursuant to the authority granted in Section 191 of Title II of the United States Code and clause 2(m)(2) of House Rule 11 today's witness will be sworn in.

Dr. Marrett, please rise and raise your right hand. Thank you very much.

[Witness sworn.]

Mr. WOLF. Let the record reflect that the witness answered in the affirmative. You are not the only one to be sworn in, everyone with the government is being sworn.

Thank you very, very much. With that you may proceed. Your full statement will appear in the record.

TESTIMONY OF ACTING DIRECTOR MARRETT

Ms. MARRETT. Thank you very much, Chairman Wolf and Ranking Member Fattah and Dr. Harris. It is an honor to have this opportunity to testify about the National Science Foundation's fiscal 2015 request, so I am very pleased to appear before you today.

For over 60 years NSF has been a strong steward of the scientific discovery and innovation that has been crucial to increasing America's economic strength, global competitiveness, national security, and overall quality of life.

NSF has had an extraordinary impact on scientific and engineering knowledge and capacity. We represent only four percent of the total federal budget for research and development, but account for 50 percent of the non-medical fundamental research at academic institutions. In fact, NSF is the only federal agency that supports all fields of science and engineering research and the educational programs that sustain the research across generations.

NSF relies on a merit-based competitive process that is critical to fostering the highest standards of excellence and accountability, standards for which NSF is known and emulated all over the world.

NSF funding results permeate society. From Doppler Radar to MRI scans, from the internet to nanotechnology, from Google to bar codes, from computer-aided design systems to tissue engineering; NSF's investments have had a profound effect on our quality of life and on American competitiveness. Just these examples have added hundreds of billions of dollars to the U.S. economy over the past 15 years.

As we know investments in fundamental research often yield unexpected results. One example is NSF support of abstract auction theory and experimental economics. NSF-supported researchers provided the FCC with its current system for apportioning the airwaves. Since 1994 these spectrum auctions have netted over \$60 billion in revenue for the federal government and more than \$200 billion in worldwide revenues.

Although the payoff was unexpected at the time NSF started supporting game theory research, the payoff is many times greater than the total investment NSF has made in the social and behavioral sciences from which much of this work has emanated.

Let me point to a few other less well-known developments with equal promise. The world's first ultrafast, ultra-accurate laser scalpel was developed by physicists and ophthalmologists at NSF's Center for Ultrafast Optical Science. Called IntraLase it replaced the old LASIK system that required a blade. It developed into a Small Business Innovation Research award, a company was formed, and IntraLase was acquired for \$808 million in 2007. So

far over five million procedures have been performed using this method, improving the vision and quality of life for millions of Americans.

Nearly 20,000 kidney transplants take place in the U.S. each year, and 4,000 patients die annually as a result of an incompatible donor match. NSF-funded researchers won a Nobel Prize for creating a computational technique that greatly expands the pool of safe exchanges for donors and recipients. As a result, paired transplants have risen dramatically.

NSF-supported researchers' discovery of bacteria living on rocks revealed how patients develop deadly blood infections from implanted cardiac devices. This research is leading to medications to prevent those infections which affect 40,000 U.S. patients annually, at a cost of nearly \$1 billion.

NSF funded anthropologists and mathematicians have reapplied algorithms that predict earthquake aftershocks to create a crime prediction model, deducing where and when property crimes are most likely to occur. After police implemented the model in Los Angeles, property crimes decreased in a particular precinct 12 percent. This technology is transforming police work in Los Angeles where 10,000 police officers protect over four million residents.

Just last week, NSF-funded scientists detailed what appears to be the first direct evidence of gravitational waves and cosmic inflation using the BICEP2 telescope in Antarctica. These findings allow us to understand the earliest characteristics of the universe; and it is the culmination of the search for direct evidence since Albert Einstein first postulated this nearly 100 years ago. This discovery of cosmic inflation may spark a renaissance in physics.

Mr. Chairman, I hope these brief examples of what basic research can do to help U.S. competitiveness are compelling. But, even if none of these breakthroughs ever occurred, NSF would still have provided students with significant research experiences throughout their schooling.

The world-class scientists, technologists, engineers, and mathematicians trained through the integration of research and education transfer new scientific and engineering concepts from universities directly to the entrepreneurial sector as they enter the workforce. This capability is one of NSF's greatest contributions to the nation's innovation system. This may be basic research's most profound and lasting impact.

Despite the economic crisis and the lingering uncertainties that have ensued, this subcommittee has worked incredibly hard to bolster NSF funding through the turbulent times of the recent past. I am very proud of the work that we have done together, Mr. Chairman. Whether it was working with you on events such as a science fair at Dulles Town Center, identifying highly successful K-12 STEM education, working with you and Ranking Member Fattah on NSF support for cognitive science and neuroscience, or the ability to use the Foundation's convening powers on areas of national discourse like youth violence, I believe that together we have made an impact. And I know our new director, Dr. France Córdova, looks forward to meeting with you at the earliest opportunity following her swearing in next week.

And finally, Mr. Chairman, in recognition of your upcoming transition I know I speak for everyone at the National Science Foundation and the National Science Board, whose chair is here with me today, I speak for everyone in thanking you for your unwavering support of the Foundation, your commitment to science, engineering, and education; and your service to the nation.

I would be happy to respond to any questions, so thank you for this opportunity.

[The information follows:]



**Dr. Cora Marrett
Acting Director
National Science Foundation**

**Before the
Committee on Appropriations
Subcommittee on Commerce, Justice, Science and Related Agencies
United States House of Representatives**

**on
The President's Fiscal Year 2015 Budget Request
for the National Science Foundation**

March 27, 2014

Chairman Wolf, Ranking Member Fattah, and Members of the Subcommittee, it is my privilege to be here with you today to discuss the National Science Foundation's fiscal year (FY) 2015 Budget Request.

The President's FY 2015 Budget Request reflects wise stewardship of federal funding through innovative, targeted investments during these times of constrained budgets. The Request totals \$7.255 billion, an increase of \$83.08 million (1.2 percent) over the FY 2014 enacted level. The FY 2015 Request provides robust support for core programs in fundamental research and education in all fields of science and engineering. This investment moves our nation forward by connecting the science and engineering enterprise with potential economic, societal, and educational benefits in areas critical to creating high-quality jobs, growing the economy, and ensuring national security.

An additional \$552.0 million is proposed through the Opportunity, Growth, and Security Initiative (OGSI) for NSF, recognizing that additional investment in FY 2015 can spur economic progress, promote opportunity, and strengthen national security. At NSF, OGSI will ensure strong support for core activities that transform the frontiers of learning and discovery. The additional investment provided through this initiative will accelerate progress in broad areas of science and engineering that address clearly defined national priorities, such as advanced manufacturing, clean energy, cybersecurity, cognitive science and neuroscience, and STEM workforce development.

NSF is the only federal agency with a mandate to support research and education in every discipline. The results of frontier research have a long record of improving lives and meeting national needs. They are the very bedrock of economic growth; the path to sustainability in energy, agricultural, and environmental domains; the seeds of the next technology revolution; and the foundation for advances in medicine. Sustained momentum in NSF's core programs is essential for progress in science and engineering. NSF's broad scope uniquely positions us to integrate the natural sciences and engineering with social, behavioral, and economic sciences to address the complex societal challenges of today. For all these reasons, the FY 2015 Budget Request provides increased support for the core fundamental research programs across NSF.

NSF: Building a Foundation for Success

NSF has played a significant role in U.S. prosperity, and in the education and development of the nation's science and engineering workforce. For decades, NSF has supported scientists and engineers in their pursuit of world-changing discoveries and innovation that, in turn, created opportunities for private sector growth and for Americans to have good jobs.

Since 1952, the first year that NSF awarded research grants, 212 Nobel Prize recipients have received NSF funding at some point in their careers for their work in physics, chemistry, medicine, and economics. Today, their transformative work addresses society's grand challenges in the areas of energy, environment, and health, as well as national and economic security.

The United States has a long history of investment in and deployment of technological advances derived from advances in basic research facilitated by NSF. For example, research funded by NSF at the National Center for Atmospheric Research and universities was instrumental in the development of Doppler radar, which benefits most Americans regularly through improved weather forecasting. NSF-supported fundamental research in physics, mathematics, and high-flux magnets led to the development of today's magnetic resonance imaging (MRI), employed ubiquitously throughout medicine.

Furthermore, NSF provides a much-needed bridge between research and discovery that would otherwise be neglected and remain untapped by the commercial marketplace. In the 1970's, research on solid modeling by NSF-funded scientists at Carnegie Mellon University led to widespread use of Computer-Aided Design and Computer-Aided Manufacturing, which together have revolutionized much of the U.S. manufacturing industry. NSF was willing to encourage investigations into design problems that neither private firms nor federal mission agencies were willing to address.

While discovery and innovation underpin our global leadership in science and engineering, and consistently provide pathways for entrepreneurs, these activities are also first and foremost human endeavors. Thus, they demand the development of a highly skilled science, technology, engineering, and mathematics (STEM) workforce. NSF strives to ensure that students from diverse backgrounds, including women, underrepresented minorities, and persons with disabilities, have sufficient opportunities to engage in empowering learning experiences and

inspiring research, no matter their economic circumstances. Sustaining such a world-class workforce is critical.

Federal investments in fundamental science and engineering and STEM training are increasingly important to help establish U.S. leadership in next-generation technologies, especially as other nations intensify their support of research, development, and education. It is crucial that we measure up due to unprecedented global competition for the world-class talent who generate innovative scientific ideas and make up the technical workforce. Despite the constrained budget environment, we must make reasonable investments to secure our nation's future prosperity.

NSF will continue its role as the nation's innovation engine. The fuel for that engine is fundamental research. Scientific research, with its long-term perspective, strong emphasis on disciplinary excellence, and multi-disciplinary interactions, is a critical foundation for both transformational science and economic competitiveness. For all these reasons, the FY 2015 Budget Request provides robust support for the core fundamental research programs across NSF.

The NSF FY 2015 Budget Request

Budget Rationale

The FY 2015 Budget Request for the National Science Foundation continues the tradition of a thoughtful and strategic balance between core research activities both within and across disciplinary boundaries and activities that address emerging areas and clearly identified national priorities. Bolstering and advancing the types of core investments that have been central to the agency's past success reflects a wise stewardship of NSF's federal funding and ensures a strong return on taxpayer investment. In addition, specific investments identified for FY 2015 align NSF's portfolio with overarching challenges and opportunities facing the Nation. This balanced approach ensures that NSF will continue to foster research that catalyzes the development of scientific discovery, promotes creation of new knowledge, and builds human capacity for the workforce of tomorrow.

2014-2018 Strategic Plan

Integral to FY 2015 budget request is the NSF Strategic Plan for 2014-2018: *Investing in Science, Engineering, and Education for the Nation's Future*. The goals and strategies outlined in the plan build on lessons learned from NSF's past successes and continue to uphold NSF's mission: "To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense...."

The plan presents the following goals, which guide this FY 2015 Budget Request:

- "Transform the Frontiers of Science and Engineering" aims to expand and explore the frontiers of human knowledge to enhance the power of the Nation to meet its challenges,

and to create new paradigms and capabilities for scientific, technological, and economic leadership in an increasingly fast-paced, competitive world.

- “Stimulate Innovation and Address Societal Needs through Research and Education” strives to focus NSF’s research communities on opening up new avenues to address high priority national challenges, as well as encourages formation of partnerships with industry, other agencies, and international counterparts to leverage resources and build capacity.
- “Excel as a Federal Science Agency” focuses on efficiently and effectively executing the agency’s responsibilities and achieving the flexibility and agility required to meet the quickly evolving challenges associated with the first two strategic goals.

Cross-Foundation Investments

The emergence of NSF’s major cross-Foundation investments is the result of years of NSF support for fundamental research across all fields of science and engineering. This enduring base of knowledge and discovery positions NSF to contribute to areas of vital national importance.

Cognitive Science and Neuroscience is a \$29.0 million investment that draws together under one framework ongoing cognitive science and neuroscience research and NSF’s contributions to the Administration’s Brain Research through Advancing Innovation and Neurotechnologies (BRAIN) Initiative. Improved understanding of the brain will promote brain health; enable engineered solutions that enhance, replace, or compensate for lost function; improve the effectiveness of formal and informal educational approaches; and lead to brain-inspired smarter technologies for improved quality of life.

Cyber-enabled Materials, Manufacturing, and Smart Systems (CEMMSS) aims to integrate a number of science and engineering activities across the Foundation – breakthrough materials, advanced manufacturing, robotics, and cyber-physical systems. It addresses pressing technological challenges facing the Nation and promotes U.S. manufacturing competitiveness. CEMMSS is aligned with key interagency activities, including the Administration’s Materials Genome Initiative, Advanced Manufacturing Partnership, and the National Robotics Initiative. While funding declines from the previous year, NSF maintains a strong overall investment in CEMMSS, at \$213.20 million in FY 2015.

Cyberinfrastructure Framework for 21st Century Science, Engineering, and Education (CIF21) accelerates and transforms the process of scientific discovery and innovation by providing advanced cyberinfrastructure and new capabilities in computational and data-enabled science and engineering (CDS&E). In FY 2015, NSF will continue to lead the Big Data program that strives to enable breakthrough discoveries and innovation in science, engineering, medicine, commerce, education, and national security. Decreases in CIF21 in FY 2015 are primarily a result of shifting investments in the cross-directorate Computational and Data-Enabled Science

and Engineering program to other targeted programs. In FY 2015, NSF will invest \$124.75 million in this program.

Science, Engineering, and Education for Sustainability (SEES) aims to increase understanding of the integrated system of supply chains, society, the natural world, and alterations humans bring to Earth, in order to create a sustainable world. In FY 2015, SEES enters a transition period toward sunsetting in FY 2017. At \$139 million in FY 2015, SEES continues to support important scientific and societal contributions during the phase-down period and will make significant progress towards achieving programmatic goals through projects currently underway.

The **Secure and Trustworthy Cyberspace (SaTC)** investment aims to build the knowledge base in cybersecurity that enables discovery, learning and innovation, and leads to a more secure and trustworthy cyberspace. Through a focus on long-term, foundational research, the SaTC investment in FY 2015 of \$99.75 million will develop the scientific foundations for cybersecurity research for years to come. SaTC aligns NSF's cybersecurity investments with the four thrusts outlined in the national cybersecurity strategy, *Trustworthy Cyberspace: Strategic Plan for the Federal Cybersecurity Research and Development Program*. Funding for SaTC declines in FY 2015, principally because a component program, the CyberCorps: Scholarships for Service (SFS), decreases by \$20.0 million.

Priorities and Highlights

Advanced Manufacturing research holds tremendous potential for significant short-term and long-term economic impact by promising entirely new classes and families of products that were previously unattainable. In FY 2015, NSF's investment emphasizes several emerging opportunities including cyber-physical systems, advanced robotics research, scalable nanomanufacturing, sensor and model-based smart manufacturing, educational activities to support training the next generation of product designers and engineers, and industry-university cooperation. In FY 2015, NSF will invest \$150.70 million in these activities.

Clean Energy investments of \$361.95 million that will lead to future clean energy and energy efficient technologies are seen throughout the NSF portfolio, both in core research programs and targeted investments such as BioMaPS and SEES. Specific activities include research related to sustainability science and engineering, such as the conversion, storage, and distribution of diverse power sources (including smart grids), and the science and engineering of energy materials, energy use, and energy efficiency.

Innovation Corps (I-Corps) improves NSF-funded researchers' access to resources that can assist in bridging the gap between discoveries and downstream technological applications. In FY 2015, NSF will invest \$24.85 million to continue to support for I-Corps Nodes and I-Corps Sites to further build, utilize, and sustain a national innovation ecosystem that augments the development of technologies, products, and processes that benefit the Nation.

National Robotics Initiative (NRI) is a concerted program to provide U.S. leadership in science and engineering research and education aimed at the development of next generation robotics,

conceived as robots that work beside, or cooperatively, with people in areas such as manufacturing, space and undersea exploration, healthcare and rehabilitation, military and homeland surveillance and security, education and training, and safe driving. NRI is an interagency effort supported by NSF, the National Aeronautics and Space Administration (NASA), the National Institutes of Health (NIH), and the U.S. Department of Agriculture (USDA). In FY 2015, NSF will invest \$28.50 million in this program.

Research at the Interface of Biological, Mathematical, and Physical Sciences (BioMaPS) is a collaboration among the Directorates for Biological Sciences, Mathematical and Physical Sciences, and Engineering that seeks to discover fundamental knowledge at the intersections of these established disciplines. This \$29.27 million activity will produce critical knowledge needed to catalyze the development of new technologies essential to the Nation's prosperity and economic competitiveness and will advance emerging areas of the bioeconomy, as described in the Administration's *National Bioeconomy Blueprint*.

NSF aims to increase the operational efficiency of U.S. activities in the Antarctic by continuing progress on a multi-year commitment toward more efficient and cost-effective science support as recommended by the U.S. Antarctic Program (USAP) Blue Ribbon Panel (BRP) report, *More and Better Science in Antarctica through Increased Logistical Effectiveness*. Emphases include safety and health improvements, investments with positive net present value, and facilities renewal at McMurdo and Palmer stations. Additionally, NSF aims to plan and execute more effective observational approaches to the Antarctic science community, as outlined in the 2011 National Research Council report, *Future Science Opportunities in Antarctica and the Southern Ocean*. In FY 2015, NSF will invest \$18.50 million in this area.

Science, Technology, Engineering, and Mathematics (STEM) Education

NSF's STEM education investment, centered in the Directorate for Education and Human Resources (EHR), supports bold programs and innovative projects that lead to impact by meeting the needs of end-users – students, teachers, researchers, and the public. This request continues the trajectory of those investments and furthers NSF's key role as an innovator and a leading funder of STEM education within the federal portfolio.

In keeping with the Administration's priorities and the strategic goals for STEM education as described in the National Science and Technology Council's Committee on STEM Education Strategic Plan, NSF's key investments for FY 2015 focus on areas where NSF is the identified lead in STEM education, notably graduate education and undergraduate education, and they also emphasize the need to strengthen foundational STEM education research. Four key activities in FY 2015 include:

The **Graduate Research Fellowship (GRF)** program is a national-level competition that supports the outstanding scientists, engineers, educators, and entrepreneurs of the future. The ranks of NSF Fellows include numerous individuals who have made transformative breakthroughs in science and engineering research, with 30 Fellows having been honored as Nobel laureates. In FY 2015, this \$333.44 million investment will provide 2,000 new awards

and the stipend level will be increased from \$32,000 to \$34,000. The development of additional targeted opportunities for Fellows to enrich their professional growth will continue.

NSF Research Traineeships (NRT) enters its second year in FY 2015 at \$58.20 million. NRT identifies priority research themes that both align with NSF priority research activities and have strong potential in areas of national need where innovative practices in graduate education can be developed. NRT investments aim to advance the research agenda of these themes, as well as develop and conduct research on new approaches and models for educating the next generation of scientists and engineers. NRT funding also includes \$7.0 million for a new track that will invite proposals for design, innovation, and research in graduate student training and professional development. Funding level shown above includes \$20.32 million for continuing grant increments for the Integrative Graduate Education and Research Traineeship Program (IGERT), which transitioned to NRT in FY 2014.

The Improving Undergraduate STEM Education (IUSE) program is a more extensive coordination of NSF's undergraduate STEM education investments within a framework designed to accelerate improvement and measurable impact in undergraduate STEM education. IUSE is built upon a knowledge base accumulated from decades of research, development, and best practices across the Nation in STEM undergraduate education, and it integrates theories and findings from education research with attention to the needs and directions of frontier science and engineering research. In FY 2015, NSF will invest \$118.48 million in this program.

Research Experiences for Undergraduates (REU) Sites and Supplements, an investment of \$75.13 million, will continue to provide early opportunities to conduct research for students in their first two years of college, as recommended by the President's Council of Advisors on Science and Technology (PCAST) in their report, *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics*.

World Class Scientific Infrastructure

The world-class equipment and facilities that NSF supports are essential to the task of discovery. In FY 2015, NSF requests funding to continue construction of three projects: the Daniel K. Inouye Solar Telescope, the Large Synoptic Survey Telescope, and the National Ecological Observatory Network. Funding concludes in FY 2014 for two projects, the Advanced Laser Interferometer Gravitational-wave Observatory and the Ocean Observatories Initiative.

The Daniel K. Inouye Solar Telescope, formerly known as the Advanced Technology Solar Telescope, will enable study of the sun's magnetic fields, which is crucial to our understanding of the types of solar variability and activity that affect Earth's civil life and may impact its climate. The FY 2015 investment is \$25.12 million.

The Large Synoptic Survey Telescope will produce an unprecedented wide-field astronomical survey of our universe, including the deepest, widest-field sky image ever. This survey will

change every field of astronomical study, from the inner solar system to the large scale structure of the universe. The FY 2015 investment is \$79.64 million.

The **National Ecological Observatory Network** will consist of geographically distributed field and lab infrastructure networked via cybertechnology into an integrated research platform for regional to continental scale ecological research. The FY 2015 investment is \$96.0 million.

Excellence in Operations

To “Excel as a Federal Science Agency” is an internally focused strategic goal that seeks to integrate mission, vision, and core values to efficiently and effectively execute our activities and provide the flexibility and agility required for all aspects of its operations. It entails blending strong scientific leadership with robust organizational leadership, both characterized by vision and flexibility, and also supporting the staff with the information and other resources that are essential to carry out the agency’s activities. This goal incorporates a culture of continuous improvement to ensure effective, inclusive, and accountable programs and merit review processes that provide the greatest value for taxpayer dollars.

Staffing

In FY 2015, NSF will work towards full utilization of its established FTE allocations, which remain unchanged from the FY 2014 Request at 1,352 FTE. The additional FTE will be utilized to address the agency’s highest priority workforce needs.

Future NSF

The Agency Operations and Award Management (AOAM) account includes \$30.04 million for Future NSF, a multi-year effort associated with NSF’s upcoming headquarters relocation. This includes funding for the project management office, IT requirements (including wiring, IT set-up, and infrastructure), and build-out related items such as furniture and filing systems.

Efficient Management

NSF’s FY 2015 Request follows a thorough examination of programs and investments across NSF to determine where the potential exists for more innovative investments. In addition to last year’s proposals, this Request includes three terminations, one reduction, and one lower-priority program elimination, totaling \$26.49 million.

Science of Learning Centers (-\$11.99 million): the SLC program has been a ten year cross-foundation activity, supported by the Directorates for Social, Behavioral and Economic Sciences; Biological Sciences; Computer and Information Science and Engineering; and Engineering. The program supported six large-scale, long term centers that created the intellectual, organizational, and physical infrastructure needed for the advancement of Science of Learning research. Four of the six existing centers reached the end of their ten-year funding cycle at the end of FY 2014; the remaining two centers reach a planned sunset at the end of FY 2015. Funding for Science of

Learning research will continue within SBE through a program of the same name which is not center-based.

Enhancing the Mathematical Sciences Workforce in the 21st Century (EMSW21) (-\$4.31 million) is a Division of Mathematical Sciences (DMS) workforce program offering that has accomplished its original goals. A replacement program is currently in development to better meet current national needs for the training of the next generation of researchers in the mathematical and statistical sciences.

University Radio Observatories (URO) (-\$1.19 million) has been superseded scientifically by the Atacama Large Millimeter/submillimeter Array (ALMA), and thus the MPS/AST Portfolio Review recommended terminating this program. Individual university-based observatories will have opportunities for funding through the Mid-Scale Innovations Program in MPS/AST.

The **Network for Earthquake Engineering Simulation (NEES)** program (-\$8.0 million) is reduced because two NSF-supported studies recommended support for a smaller “second generation NEES” instead, which will allow additional investments to be made in research that addresses engineering strategies to design for and mitigate against multiple hazards. This rebalancing of facilities and research programs provides a more efficient and effective strategy to meet the needs of the civil and earthquake engineering-related research communities.

The **Virtual Astronomical Observatory (VAO)** (-\$1.0 million) is a lower priority program for NSF. VAO will be transitioned to a new joint NSF/NASA program as operational reviews have shown that the current activity is not meeting the needs of the community in an efficient and cost-effective manner.

Conclusion

With intense global competition for knowledge and talent, we must focus our attention on finding the sophisticated solutions that will ensure a prosperous, secure, and healthy future for the nation and the world. Robust NSF investments in fundamental science and engineering research and education have returned exceptional dividends to the American people, expanding knowledge, improving lives, and ensuring our security. To keep those benefits flowing, we need to constantly replenish the wellspring of new ideas and train new talent while serving as good stewards of the public trust. That is the fundamental and continuing mission of NSF.

Mr. Chairman and members of the Subcommittee, I hope my testimony explains how the Foundation plays a vital role in ensuring that America remains at the epicenter of the ongoing revolution in research, innovation, and learning that is driving 21st century economies. More than ever, the future prosperity and wellbeing of Americans depend on sustained investments in our science and technology. NSF has been and continues to be central to this endeavor.

This concludes my testimony. I thank you for your leadership, and I will be pleased to answer any questions you may have.

Mr. WOLF. Well, thank you very much, I appreciate your comments.

My wife and I have 16 grandkids, and I am worried that our nation is basically facing decline. I think we are facing economic decline, and I know people don't want to hear it but we are facing scientific decline and moral decline. Just look around. And so one of the reasons I think Mr. Fattah and I and the other members here have been supportive of NSF is because we want to continue seeing America to be number one.

We are entering decline. Decline does not mean it has to be permanent, but it will be unless there is some dramatic action. I am not speaking for anybody else here on the Committee, but I am just speaking for myself. I have never been more concerned for our country. That is one of the reasons we have always wanted to make sure that science is protected and fostered. If I were ever running a government, I would plus up sciences and do some things. But that is another story.

RESEARCH FUNDING PRIORITIES

Most of the cross-cutting research initiatives that have been priorities in recent budget years, including advanced manufacturing, cyber security, and cyber infrastructure are expected to decrease in your request. What will the impact of these decreases be? Are we at risk of losing momentum in these disciplines? These are not gotcha questions to make you look bad. I don't ever want to put a witness through a difficult time, but is there a potential that we lose momentum?

Dr. MARRETT. I think the answer is yes, there is the possibility.

What we are very much interested in right now is the fact that in terms of science and international competitiveness we are still ahead of lots of parts of the world. But what's going on is the rate of progress elsewhere is outpacing what we are undertaking. Thus the question becomes do we need to change that pace in order to maintain our standing in what is a very different climate from what we have had in the past?

So I understand fully and, certainly, I think all of my colleagues at the National Science Foundation and actually across the science agencies share these concerns. But at the same time we are also aware of where some of the constraints are on our own budget possibilities that we don't want to seem out of line with what could take place.

But we are more than willing to share with all of you that are interested, and to ask about what might be some directions we should consider in the context in which we are operating.

U.S. RESEARCH AND DEVELOPMENT SUPPORT: INTERNATIONAL CONTEXT

Mr. WOLF. Well how does our budget for the sciences compare with China today?

Dr. MARRETT. We are still—

Mr. WOLF. Dollar wise.

Dr. MARRETT. Yes. We are ahead in terms of the actual expenditures. It is the rate of growth, the percent of the GDP that is really making the difference.

Mr. WOLF. Can you put them in context?

Dr. MARRETT. I don't have the exact numbers, although I will have them shortly. Here is the chair of the National Science Board, incidentally. Yes. We have the information. In fact, this information is incorporated in Science and Engineering Indicators and that is the volume that the board sponsors and publishes. That is the first rate volume that is now showing us where we are relative internationally, especially to China and Asia, more generally.

Mr. WOLF. For the court reporter, can you kind of go through that a little bit? Identify your name—

Dr. MARRETT. Yes, he would, why not.

Mr. WOLF. Identify your name for the gentlemen.

Dr. ARVIZU. Okay. I am Dan Arvizu, I am the chairman of the National Science Board, and in the 2014 Science and Engineering Indicators a couple of things that came out of that was that the overall spending in R&D in the U.S. is \$459 billion. China is roughly—I'm sorry, \$429 billion, China is \$208 billion, that is public and private R&D.

Mr. WOLF. And what are the trends? Where was China five years ago, ten years ago, and what are the projections?

Dr. ARVIZU. Yeah, so they are increasing, as Acting Director Marrett has said, they are increasing at a rate that is much greater than ours.

What's interesting from the Science and Engineering Indicator data is that roughly our R&D community, the span that is in our R&D actually represents about 40 percent of our GDP. In China that is roughly 30 percent, but it is increasing. So their proportion of their R&D spending relative to their economy is getting larger at a faster rate than our opening statement. So ours is larger still, but they are catching up.

Mr. WOLF. Are there any projections of 2020, for instance?

Dr. ARVIZU. So, actually there are that are not part of the Science and Engineering Indicators. But Battelle R&D has actually done those projections, and they project that by the year 2022, China's R&D spend will be greater than the U.S.'s.

Mr. WOLF. Well, 2022.

Dr. ARVIZU. Yeah.

NSF FY 2015 FUNDING LEVEL IMPACTS

Mr. WOLF. As discussed during the opening statement, your budget request this year proposes a small decrease in your major research account while programmatic increases are focused instead on NSF's STEM education programs. Why do you consider the STEM programs to be the highest priority this year?

Dr. MARRETT. Yes, in terms of the budget for STEM education, much of that is accounted for by the increases proposed in the Graduate Research Fellowship program. We would be adding 2,000 additional fellows and increasing the stipend. This is a high priority area for the nation. That is the reason in part. But primarily when we have to make trade-offs and there have to be increases that we see as so significant, then those come with reference to, then where can we make alterations? And in the case of the Research and Related Activities account where you see some of the

declines, those are often areas that we think have met the maturity where there is no longer a need for setting aside.

We will still be able to support them, but that is the way this comes off why it looks as if the funding for the Education and Human Resources account. The growth is there and you don't see that for what the request looks like for research and related activities.

Mr. WOLF. Okay, I am going to go to Mr. Fattah now.

If you can give me just a letter, maybe we will put it in the record, on America compared to China and compared to maybe two or three others of the top tier. Just describe where we are today, where we were ten years ago, and then the projections taking us to 2022.

Science and Engineering Indicators 2014 (SEI) reports data on current research and development (R&D) expenditures in the United States (\$429 billion in 2011) and China (\$208 billion in 2011) (Table 4-4).¹ The United States is by far the largest R&D performer, accounting for just under 30 percent of the global total, but down from 37 percent in 2001. China, at 15 percent of the global total and exhibiting the world's most dramatic R&D growth pattern, was the second-largest performer in 2011. In constant 2005 dollars, U.S. R&D has grown from \$309 billion in 2001 to \$342 billion in 2006 to \$379 billion in 2011; the corresponding figures for Chinese growth are \$35 billion, \$84 billion, and \$183 billion (Appendix table 4-14). Growth in total U.S. R&D averaged 2.1 percent over the ten-year period ending in 2011. In contrast, growth in China's R&D averaged 18.0 percent annually over the same period. More detail is available in Ch. 4, pp. 4-16 to 4-22. Thus, while the United States is still ahead in terms of total R&D spending, China has a much faster rate of growth for this spending.

This is also confirmed using a second measure commonly used when comparing international R&D expenditures, which expresses national R&D expenditures as a percentage of gross domestic product (GDP), providing a means to adjust for differences in the sizes of national economies. *Science and Engineering Indicators 2014* shows the U.S. R&D/GDP ratio increasing modestly over the ten-year period ending in 2011 (2.72 percent in 2001, 2.64 percent in 2006, and 2.85 percent in 2011), with most growth attributed to nonfederal R&D spending. China's ratio doubled over the same period, increasing from 0.95 percent in 2001, to 1.84 percent in 2011 (Ch. 4, pp. 4-18 to 4-20).

As referenced in the hearing testimony, in December 2013, Battelle Memorial Institute released a report that includes global R&D investment projections.² According to the Battelle report, given current growth rates, China's investment in R&D is projected to surpass that of the U.S. by the year 2022. SEI does not make projections.

¹ <http://www.nsf.gov/statistics/seind14/>

² http://www.battelle.org/docs/tpp/2014_global_rd_funding_forecast.pdf?sfvrsn=4

Mr. Fattah.

Mr. FATTAH. Thank you, and welcome again.

So I have looked through the request and obviously as the committee goes through its mark-up phase we are going to be looking to be very supportive of the foundation and its work.

COGNITIVE SCIENCE AND NEUROSCIENCE

Obviously for me there are some things that are superior among all of the other things that you are doing and neuroscience happens to be at the very top of my list. I want to walk through your 2015 request.

Dr. MARRETT. Sure.

Mr. FATTAH. So you are requesting \$29 million for cognitive science and neuroscience.

Dr. MARRETT. That's correct.

Mr. FATTAH. Specifically including \$20 million for the BRAIN initiative. Is that—

Dr. MARRETT. Yes, that's right.

Mr. FATTAH [continuing]. That correct.

And compared to you did 20 million in 2014 in the omnibus that we just passed, right?

Dr. MARRETT. Yes.

Mr. FATTAH. And in terms of your total base in the 2014 on neuroscience it is about \$70 million?

Dr. MARRETT. That's right.

Mr. FATTAH. Can you talk just a little bit, just to give us the bullets on that?

Dr. MARRETT. Let me walk you through—all of these figures there.

When we submitted our request for 2014 we included there the specific cognitive science and neuroscience investment. Thanks very much to this committee. I am saying this is an emphasis we put in the request. Subsequently the President announced the BRAIN initiative, but we had already submitted our 2014 request.

Mr. FATTAH. Yes.

Dr. MARRETT. We made a commitment of \$20 million for that initiative. What we have to do then is to say that \$20 million would come out of funding that we ordinarily do—

Mr. FATTAH. Right.

Dr. MARRETT [continuing]. Out of cognitive science and neuroscience.

So the 2015 request is the first time we will have a chance to have something specific—

Mr. FATTAH. Right.

Dr. MARRETT [continuing]. For the BRAIN initiative. That is why you see that \$15 million there.

[The information follows:]

Per NSF:

Current text reads: "15 million"

Corrected text should read: "\$20 million"

Mr. FATTAH. Well thank you.

Dr. MARRETT. Okay.

ROLE OF BASIC RESEARCH

Mr. FATAH. I was out, Mr. Chairman, at University of Pittsburgh, I visited there in Carnegie Mellon. I met—

Mr. WOLF. Is that the team that Penn State used to beat every year?

Mr. FATAH. Yeah, absolutely.

So I was there, I visited their neuroscience lab and I saw a young lady who is in her 50's, she is had a—unfortunately was inflicted with a brain disease that took away her motor functions, control of her motor functions but her mind works very, very well. And Dr. Andrea Schwartz who got a grant for the National Science Foundation 30 years ago, he had a simple proposition. He was trying to figure out what happens in the brain of a monkey when the monkey moves his arm, what neurons fire off? And he just kind of taking a look of this.

And over 30 years of research what this has resulted to at the University of Pittsburgh is I got a chance to get a high five and a fist pump from this young lady who is controlling her artificial limb by using her mind some 30 years later.

This is a result of basic scientific research, Dr. Harris, that progressed over many, many years looking at what some of our colleagues would go to the floor today and say look at this waste of taxpayer's money, you know, some researcher wants to look at what happens in the brain of a monkey when the monkey moves his arm, but today this young lady is able to function. And there are 250,000 people in the world who have something implanted in their brain, right, in order to help them to be able to function a little bit better in the world that we live in.

And I just want to mention this because it is very, very important for us to understand that all of these major breakthroughs happen because of basic scientific research, this is what the claim to fame of the National Science Foundation is. And so I saw it and I even posted this YouTube on my Twitter account so people can see, and it is just an amazing thing. But there is so much more that could happen and there is more work for us to do.

And I appreciate, we had a chance for you to brief me on some of the details of some of the research that the foundation is supporting when we were together at the national—at the Society for Neuroscience out in San Diego, so it is good to see you again, and we want to make sure that as you go through this budget process that we make these investments.

And the chairman has been the biggest support of science. I know we are all concerned about his retirement, I am trying to convince him to change his mind, but the point is the country has to make these investments.

So thank you very much and I will yield back for this round.

Mr. WOLF. Dr. Harris.

Mr. HARRIS. Thank you, and thank you Doctor for appearing before the committee.

Mr. Chairman, I do want to associate myself with your comments. I think what you said about the decline in general is reflective of the way I feel as well, and it does impact the National Science Foundation. Because I think, you know, just as the figures

you stated about the growth in for instance China's investment in science you could create a parallel chart that shows China's economic growth versus our relatively stagnant economic growth, and that in a country with stagnant economic growth we just simply aren't going to be able to afford the kinds of investments that we need to especially when we are obviously prioritizing entitlement spending over discretionary spending.

Look, that is the bottom line. We can't deal with entitlement spending and the growth of it in this country and it will choke out discretionary spending, and unfortunately your budget is under the discretionary budget.

But, you know, I am going to associate myself with what the ranking member said about basic research, this is incredibly important, and when I view—and we just had the hearing in my own subcommittee on the NIH yesterday, when I view the function of the federal government in these kind of research areas the main function I want do the basic research because there is no industry is going to do the basic, they are just not going to do it. I mean it is not readily commercialized. They won't do it.

The other thing are the young investigators. You have to promote young investigators. Because again, no industry is going to do it. They always want the fully trained investigator coming, and you know, they will grab them up and that is fine, but we have to do that. So I am going to lead down that path with my remaining time.

Let me just get the China figures right. The China figures you had were what was the total spending, and did it include medical research R&D as well?

Dr. MARRETT. Does it include medical? Yes, it does.

Mr. HARRIS. And what was the number, the most recent number?

Dr. MARRETT. \$208 billion.

Mr. HARRIS. About 208 billion in China and we are at 459; is that right?

Dr. MARRETT. \$429 billion.

Mr. HARRIS. Four twenty-nine. Because, you know, actually that would indicate that China is obviously doing a whole lot more in the non-medical sciences, because the medical science investment in China is only eight billion a year in fiscal year 2012 versus 120 billion in the United States. So, you know, this is a problem, Mr. Chairman that really is among the non-medical. I mean they are even more ahead in the non-medical sciences. We still have quite a lead in the medical sciences.

INDUSTRY PARTNERSHIPS

The one thing, I visited one of the labs funded by the NSF at Hopkins about three months ago and what I liked about it was, and I am going to ask you if we do this, is the researcher I visited did materials research funded by the NSF for years, but he was able to after a time get industry to also fund it. And I am just going to ask you, are you making efforts for your more senior level researchers to go to that other pool of research dollars available, which is basically industry?

Dr. MARRETT. Oh, I should say we do. In fact there are some programs that require a level of matching. So our centers programs,

for example, the Engineering Research Centers, the Science and Technology Centers, the Industry/University Cooperative Research Centers, Materials Research Science and Engineering Centers have industrial partners. That is one of the mechanisms.

We also have a relatively new program, the Innovation Corps, in which we have individual investigators often who have been doing, undertaking fundamental research who are not quite sure whether there is a marketable possibility there. Through this program they have a chance to work with mentors through some educational programs and determine whether there is something that is viable there.

So yes, this idea of making the connections into the other sectors is very much a part of what we encourage.

Mr. HARRIS. Good for you, because you know, I encourage the leadership of the NIH to do the same thing. They are far behind you in that by the way. They don't encourage it and I think that that is—we have to be forward looking about that, especially in the area of, you know, budgetary restraint.

EARLY CAREER INVESTIGATOR SUPPORT

Doctor, do you know, because I asked—you know, over at NIH part of the problems with young—I mean there are metrics for young investigator promotion by a government agency and the metric that I think is useful is over the year what percent of the grants are awarded to people under age 35? That is a metric that has used with the NIH. And with the NIH over the past 23 years the number of grants have doubled, the number of awardees under age 35 has gone down by 40 percent at the NIH. Do you keep the statistic, that kind of statistic for NSF?

Dr. MARRETT. Yes, we do, and we will get the exact figures to you. We followed that closely because of a concern that has come out of the biomedical community and the fact that they sometimes talk about the aging population of awardees at NIH.

[The information follows:]

NSF tracks funding trends of its principal investigators (PIs) by stage of career. An early career PI is defined as someone within seven years of receiving their last degree at the time of award. PIs who received their last degree more than seven years from the time of award are considered later career PIs. In 2013, 22 percent of research awards were made to early career PIs, a slight increase over the 21 percent in 2012. Over the last ten years, the trend has been relatively stable, ranging from 21 percent to 25 percent.

At the time of the American Recovery and Reinvestment Act of 2009, we made a special point of ensuring that the funding would go to young investigators, to people towards the beginning of their careers, and thus this becomes extremely important. And we do make a number of efforts to try to ensure that we do not fall behind by not providing opportunities for those who really are launching careers.

Mr. HARRIS. No, no, thank you, and I appreciate that, because you know, the Chair has commented on, you know, what looked like a discrepancy, you are reducing the research budget over here but increasing the STEM budget, but in fact under the Graduate Research Fellowship Program that is research money. So although it doesn't look like it is research dollars, my reading is that you

have transferred money there but that will fund grants, the 2,000 additional grants, which I think is very—you know, I congratulate on that, I think that is kind of the proactive effort that we need to make in our scientific research funding operations.

CLEAN ENERGY: DUPLICATING EFFORTS

And I will just close by one question with you, because you know I sat on the science and technology committee before coming to this committee, and you know, my subcommittee actually had oversight over ARPA-E. Now I read this clean energy paragraph under your priorities and highlights and it was exactly what ARPA-E would have written in theirs. Are we duplicating efforts across government agencies? I mean ARPA-E, you know, is established for doing basic research. It sounds like exactly the same mission as the NSF. I mean why aren't we pulling these together and achieving efficiencies of not distributing these various programs throughout the government?

Dr. MARRETT. We in fact do work very closely with the Department of Energy, because yes, the idea is not to duplicate the activities that take place.

When we talk about the fundamental research that we undertake yes, in both instances it can be fundamental, but that doesn't mean that it is all identical. We pay a lot of attention then to what's being supported there.

I take seriously your notion of when we have got limited resources we must see that those resources are used most effectively. That is what we do in all of our programs, including the plans around clean energy.

Mr. HARRIS. Thank you, Doctor. I yield back.

Mr. WOLF. Mr. Diaz-Balart.

Mr. DIAZ-BALART. Thank you very much, Mr. Chairman. Thank you again for being here. A couple of questions.

HISPANIC-SERVING INSTITUTION SUPPORT

In the Competes Act in 2010 Congress authorized the establishment of a new program to award grants on a competitive merit review basis to Hispanic-Serving Institutions, and as far as I know NSF has not created such a program yet as far as I know. If that is the case why? Again, we are talking about something that was authorized in 2010 and so why has it not been created and do you see the establishment of this separate program being established any time soon?

And Doctor, if it is all right let me just throw a couple issues out there for you and then we can talk. And the other issue which is related is that in your budget summary, 2015 budget summary it indicates an intent to focus on Hispanic-Serving two-year institutions.

Now, for example, in south Florida, Mr. Chairman, south Florida is the home of the largest producer of STEM degrees for minorities in the country, Florida International University; it is a four-years college, it is a four-years university. Miami Dade College, a four-year college, is I believe the largest—graduates the largest numbers of African Americans in the country. I don't know if that is

still quite accurate but it was as of a few years ago. Those are four-year institutions.

So how was a decision made to focus on just two-year institutions versus four-year institutions? So two separate and related questions.

Dr. MARRETT. Well they are very closely related and I am glad you raised this because the Foundation has a deep commitment to broadening participation.

With reference to Hispanic-Serving Institutions we began by asking what is it we are seeking to do? The legislation, as we saw it, was seeking to see how do we diversify the population, the STEM population. We then asked through what mechanisms might that best be done? The four-year institutions, the problem with establishing a program specifically for all Hispanic-Serving Institutions was the concern that most of that funding would go to the institutions that are already doing well in the NSF competition, because that is a lot of the California schools, it is a lot of the Arizona schools that are very competitive.

So the question was how could we make a difference if we already knew what the distribution was? We then said, if you actually look at what is taking place with students, large numbers of Hispanic students, as you have already noted, do begin in community colleges. What we found is that a number begin with an interest in STEM, but do not stay in STEM to complete the two years; and thus are not ready for the four years.

So we are talking about the transition into four-year institutions, but we chose this two-year emphasis saying that would probably make a far greater impact on the students and the composition of what would take place than if we were simply going to say we will have a program that we will have money for whatever institution is defined as a Hispanic-Serving Institution.

Mr. DIAZ-BALART. Doctor, but has that new program, which I may be wrong, has the new program authorized in the Completes Act been created?

Dr. MARRETT. No, that is what I am describing right now.

Mr. DIAZ-BALART. Right.

Dr. MARRETT. And that directed us to create a program and that is what we have been working on ever since.

Mr. DIAZ-BALART. And when do you think that will take place?

Dr. MARRETT. It is going to take place in 2015, that is part of the base is there already. In fact with me today is the Assistant Director for Education and Human Resources and that is where we have made so much progress. We have had the discussions, we have done the analysis with the idea that we are ready because we have already had the conversations with other parts of the Foundation that are so committed to the two-year college to four-year college transition.

The only other thing I would add there is that we are also working closely with the Department of Education, because as you probably know, that is where a large sum of money was set aside specifically for Hispanic-Serving Institutions.

Our task has been how to again compliment those efforts. That is what we are putting in place, that is what you see in the 2015 request.

Mr. DIAZ-BALART. Great. And I would like to, you know, maybe when it is appropriate maybe the folks who are dealing with that maybe we can just set some time in the future to just get some feedback and understand what you are doing and how you are doing and just to make sure we are all on the same page.

Great, thank you. Thank you, Doctor.

Dr. MARRETT. Yes.

Mr. DIAZ-BALART. Thank you very much.

Thank you, Mr. Chairman.

Mr. WOLF. Thank you, Mr. Diaz-Balart.

That was an interesting point you made, Dr. Harris, about the medical versus non-medical research. When you give me the information about research funding, you can factor in what Dr. Harris said too, from a laymen's perspective. I think he makes a very good point, that the problem is even worse than what the numbers show once you take out medical research.

Just kind of make it so that if you are a person listening in and you are hearing this, it is a wow, gee whiz, that is amazing, and we have to do something about that.

NSF FY 2015 RESEARCH PURCHASING POWER

Although your agency-wide request represents a one percent increase over fiscal year 2014, the impact of that increase is likely to be wiped out by the rising cost of doing business. How will the amount of research that NSF is able to fund in fiscal year 2015 compare to what you will fund in fiscal year 2014?

Dr. MARRETT. We still estimate that we are going to make, since annually we get about 51,000 proposals, about 11,000 awards, we don't anticipate a dramatic drop in the number of awards that we will be making in 2015.

Mr. WOLF. Will there be some drop?

Dr. MARRETT. There could be some drop. Yes, any time there is some change there will be some modification, but we are not anticipating dramatic types of changes, in fact that is the way the planning is done.

Mr. WOLF. Again, this is not to get you in trouble, so you should answer this any way you feel.

Dr. MARRETT. Okay.

Mr. WOLF. I used to work for a cabinet Secretary, and I know how OMB can be. Your budget has to go over to OMB, correct?

Dr. MARRETT. Correct.

Mr. WOLF. Ultimately they are the decider; is that correct?

Dr. MARRETT. Let me say we submit budget proposals to OMB, we have lots of engaged conversations with OMB.

In this case for 2015, as you know, because there was already a budget agreement for 2014 and 2015 that sets some boundaries—

Mr. WOLF. Right.

Dr. MARRETT [continuing]. For what we were going to be able to ask for. So it is not just the OMB, but in fact it was setting certain kinds of boundaries, again that we had to work within.

Mr. WOLF. So if you could tell us what you think the decrease will be, you can submit that.

Dr. MARRETT. We will submit that, yes.

[The information follows:]

NSF estimates making 51,600 proposal decisions in FY 2015, approximately three percent more than the 50,300 proposals estimated for FY 2014. Of the 51,600 proposals, NSF estimates making 11,400 awards, a one percent increase over the 11,300 awards estimated for FY 2014. This increases slightly due to a combination of additional education grants and a small increase to the percentage of continuing grants in FY 2015. NSF can increase the overall number of new awards made in a given year in order to mitigate impact to funding rate under scenarios of increasing proposal pressure and/or decreasing funding.

Keep in mind, however, that because continuing grants require out-year commitments, they encumber future funding that could otherwise be used to make new awards. Repeatedly increasing the share of continuing grants over a number of years would increase the total 'mortgage' owed and could actually have a detrimental effect on future funding rates if high mortgage levels prevent a sufficient number of new awards from being made.

Mr. WOLF. One, three or, you know.

Dr. MARRETT. Okay, we will.

Mr. WOLF. Other major research agencies, including DoD and NIH, track annual inflation factors for research and development activities in order to monitor changes in their research purchasing power. For fiscal year 2015 these factors vary from 1.8 to 2.8 percent.

Does NSF calculate a research price index of its own, and would you find such a metric useful?

Dr. MARRETT. We have the information, it is not incorporated in the budget request, so that does not take into account inflation. I am sure you are quite aware that when the President's budget—and in fact the President's science advisor has indicated how this budget shapes up against the background of inflation, but we haven't used that in what we regularly submit.

The question of could it be useful? Perhaps so. We would like to pursue that some more with you and with your—

Mr. WOLF. Sure.

Dr. MARRETT [continuing]. Members of your staff.

Mr. WOLF. Okay, thank you.

GLOBAL RESEARCH INVESTMENTS

Back to the global issue. The United States still dominates global research and development in terms of the absolute number of dollars, but NSF reports show that our position has been declining in terms of annual growth in R&D expenditures and R&D spending as a share of GDP. That report, however, only captures data through 2011. What do you think those indicators would look like if we had more current data?

Dr. MARRETT. We think that the trends would still be there, because as Dr. Arvizo mentioned earlier, this is a part of what we see going on. So we don't think that things have changed a lot.

I know a part of your question is why only up through 2011? This has to do with the quality of data and what's available. Since our Science and Engineering Indicators relies on the best of the information, information you have got to recheck to make sure about how useful, this is why it is not always the most current. Yet as the National Science Board knows there are some other reports, other documents that give us reason to conclude that the trend is still the trend. That the pattern that was reported in 2011, is what we are seeing, as well, in 2014.

Mr. WOLF. Do you believe it is feasible for the United States to retain its long-term advantages in science and technology against countries with bigger populations and very aggressive R&D investment plans? What are the most essential policies that we need to be implementing in order to do so?

Dr. MARRETT. Do we think that that is a possibility? Yes, because there is still an advantage that the U.S. has in terms of innovation. That is the investments made in other places are not always the most innovative, or the most creative ideas. And that is why we at NSF work so hard to try to make sure that we are supporting the most innovative ideas.

I will say one other thing though that is important in this context. We are in a global context, and increasingly we have to figure out ways to work collaboratively with other countries or otherwise it is going to be very difficult for our own researchers to have access to some of the best facilities that are around.

So we are on the one hand trying always to think about how to keep the U.S. in the competitive situation, but recognizing that we have got to work collaboratively with others.

Mr. WOLF. Mr. Fattah?

Mr. FATTAH. Thank you.

COGNITIVE SCIENCE AND NEUROSCIENCE, CONTINUED

As part of that the chairman, who has been extraordinarily supportive of the work that I have been doing on neuroscience, supported me visiting the EU. I went to Ireland, I was at the Healthy Brain Healthy Europe Conference and then a few months later over to Israel for the Israeli Brain Technology Conference. For that it is now public that the EU's human brain project, which they put a billion and a half dollars in, that they have asked that I would draft an agreement in which we could cooperate with the brain initiative which our committee takes ownership of that we created the impulse for it and the EU's effort along with Israeli. So we are now putting together a memorandum of understanding and the White House and the national economic counsel and OSTP, everyone is supportive. I talked to Dr. Francis Collins.

We want you just to put on the record what you think it would mean for a combined effort around neuroscience. The brain is in my view the last most important, most significant mystery that exists. And so if you could just speak to this it would be helpful.

Dr. MARRETT. Yes, well I failed earlier to acknowledge, to recognize one of my other colleagues, Dr. John Wingfield, who had appeared before to give a very general discussion of our neuroscience, cognitive science work. That he certainly endorses the notion that we do need collaborations within the U.S. We need the collaborations across the international borders. And so you mentioned the meeting of the Society for Neuroscience. That gave us an opportunity to talk to the people who got the EU program underway. We know about what is going on in Japan, for example. There is a great deal of activity that probably could be facilitated by the kind of leadership that you are willing, that you have been taking in this area. No, we are fully behind this kind of activity.

Mr. FATTAH. Thank you very much. And I just point this out because you were saying that we need an international conversation.

The chairman has been very supportive of us trying to build the possibilities and now it is coming to fruition and there will be workshops in the Fall that will start to work through the scientific details. But we are at a moment, I think, a very significant point in which there is going to be real cooperation between nations on this matter and it is going to mean a lot. The World Health Organization says there are a billion people, Mr. Chairman, who are suffering from neurological diseases and disorders in the world. So just imagine what this effort could portend if we are able to actually not just work together but achieve real results. Thank you.

Mr. WOLF. And when you look at the impact of Alzheimer's. Mr. Culberston.

Mr. CULBERSON. Thank you, Mr. Chairman. I want to thank you so much for being with us today, Dr. Marrett, and for your service. It is an extraordinarily important job and it is such a privilege for me to serve in this subcommittee to help make sure that you all get the support that you need.

MERIT REVIEW

I wanted to ask about your impressions of the, you know, the scope of the National Science Foundation's work, the competitive peer reviewed research that is, in my opinion, so vital to what you do. To what extent have you all ever felt that you have been pressured politically to, I always worry about political, the chairman has been wonderful about making sure that you get, as this whole subcommittee has, the funding that you need. I wanted to talk to you about the level of peer reviewed scientific grant funding that you have been able to put out over the years and how you feel about this year's budget proposal, and what this committee ought to do to be sure to help you?

Dr. MARRETT. Well if what you mean by that is the merit review system still alive and well, it certainly is. That is the basis on which we make the decisions. And those are not made, as you quite well know, just by the staff at NSF. It is from this very large community that reviews, that asks about the intellectual merit, and that asks about the broader impact. So if that is what—

Mr. CULBERSON. Yes, ma'am. What percentage of the total research funding that NSF does—

Dr. MARRETT. All of our—

Mr. CULBERSON [continuing]. Is, it is entirely, 100 percent, all of it?

Dr. MARRETT. All of our—

Mr. CULBERSON. Peer reviewed, competitive—

Dr. MARRETT. That is right. Well we would prefer usually merit review, saying it is a merit system, because then you can use peers to help assess merit. But no, that is the process that we use for all of the awards that we make.

ADVANCING NANOTECHNOLOGY

Mr. CULBERSON. I share Mr. Fattah's passion and interest in the neurologic sciences and the work that is being done is just extraordinary in understanding the way the brain operates. And Houston, Texas, I have the pleasure of representing, or right next door to, I did represent until the last redistricting the Texas Medical Cen-

ter where some extraordinary work is being done. Could you talk to us a little bit about in particular the, and I actually would like you to talk about it if you could based on your own knowledge and experience some of the work that the NSF is doing in advancing nanotechnology?

Dr. MARRETT. Yes. Well, that remains a great area of emphasis at NSF. That if one looks at the recent budget request it will seem as if it is going down somewhat. But that is again because of what happens to priority investment areas. We often will take an area that seems as if it is ripe for special investment. After that area becomes much more mature, then it moves to support through our regular programs, and you do not see it then standing out in the same ways. But nanotechnology remains a very important area for the National Science Foundation because of its implications for research, for the manufacturing sectors, and other places.

LEVERAGING BASIC RESEARCH SUPPORT

Mr. CULBERSON. Do you have the ability, as some of our, you know, many of our universities do, if a particular promising piece of research pans out? For example Rice University I know has been able to generate a tremendous amount of income. University of Houston, some of the universities in Texas, if they find a particularly successful piece of work the scientist who came up with it and the university are able to retain some ownership interest. And then when it is sold and becomes, goes on the market, they actually generate a lot of money on it. To what extent can NSF do that in this era of tight budgets to help you generate some additional revenue for the vital work that you do?

Dr. MARRETT. Well as I was indicating earlier, our emphasis is on the fundamental, on the early phase parts of the activity. We do encourage, and expect in a number of instances, that there will be collaborations with the industrial sector to determine what ideas need to be fully fleshed out. We have some programs that are experimental programs, one is the Partnerships for Innovation through our Engineering Directorate. But I do not want to give the impression that NSF would itself generate a lot of additional revenue through these kinds of activities. No, those are——

Mr. CULBERSON. Certainly. We know that you are not in it to make money.

Dr. MARRETT. Okay.

Mr. CULBERSON. It is just that I am looking for ways, it really works beautifully at the university level, if they find something that is tremendously promising. The oil and gas industry is exploding because we found, or gained access to, more oil and gas in the last ten years than has ever been discovered in the history of the United States. And that is happening primarily in the Houston area. The work is extraordinary. And nanotechnology feathers into that. They are developing carbon, ways to manufacture carbon nanotubes that are then incorporated into, for example, gaskets and different pieces of machinery and equipment. And it is wildly successful. And it is spinning off vast amounts of money, not only for the private sector but also for the universities that are involved in it. And I know you all are not in it, all of us do not want you to be in this for the profit. But is there a way for NSF to make

some money on some of these extraordinary innovations, as the universities are?

Dr. MARRETT. Very interesting.

Mr. CULBERSON. It would be a nice source of extra money.

Dr. MARRETT. I would have to turn to a lot of the legal experts on what are the boundaries there. Of course we are always interested in resources. But we do have to stay very much cognizant of what our role is as a federal agency. And thus we cannot compete in ways that would be disadvantageous to others. I understand what you are—

Mr. CULBERSON. Again, not suggesting, this is you keep an ownership interest. I mean, basically, is there any way for you to generate any kind of a profit—no?

Dr. MARRETT. Bayh-Dole Act would not—

Mr. CULBERSON. By the Dole Act?

Dr. MARRETT. The Bayh-Dole Act.

Mr. CULBERSON. The Bayh-Dole Act? Okay.

Dr. MARRETT. Yes. That is the one that was so important for what can happen for the intellectual property that comes out of what—

Mr. CULBERSON. Because it is generated with tax dollars, it is for a public purpose, it therefore, essentially, who, you know, the public in general should benefit, I assume.

Dr. MARRETT. I will tell you what—

Mr. CULBERSON. Oh, universities only are the ones that can do that?

Dr. MARRETT. That is right.

Mr. CULBERSON. Okay.

Dr. MARRETT. I think what we would like is just sometimes to get the recognition of the contributions we have made.

Mr. CULBERSON. A thank you? How about a thank you every now and then?

Dr. MARRETT. Yes.

Mr. CULBERSON. We will do our best to say thank you when we get our final bills in. Thank you, ma'am.

Mr. WOLF. Mr. Schiff.

Mr. SCHIFF. Thank you, Mr. Chairman. Welcome back to the subcommittee and thank you for the extraordinary work done by the Foundation. The recent announcement of the confirmation of the inflation that took place in the trillionths of a second following the Big Bang is extraordinary and humbling, and it could not have taken place without the participation of NSF which runs the Antarctic station where BICEP 2 performed its observations and which co-manages the telescope with NASA. I hope you will go beyond that today and tell us what took place before the Big Bang. And if not, why NSF has not figured that out by now.

I support your work and I think our national investment in science and research touches every facet of our national life and has been a key driver of America's technology and economic prowess. I support the President's budget request for NSF for fiscal year 2015 and I really wish we could be investing even more, especially as other nations are arising to challenge our preeminence.

MANAGEMENT OF MAJOR MULTI-USER RESEARCH FACILITIES

I have one question that goes to the wise expenditure of public resources. Major scientific research facilities, especially those that have been supported through NSF's major research and equipment facilities construction account, are the backbone of America's scientific enterprise. These facilities create opportunities for scientists from across the nation and around the world to work together to foster innovation and make the next great scientific discovery. What is NSF doing to protect the taxpayer investment in these facilities and ensure they are being run to their maximum potential during this period of constrained budgets?

Dr. MARRETT. We have a very detailed, very much of a process for examining, making sure that proposed investments in facilities are to be dealt with in the best ways possible. And then once the decision is made there is the continual monitoring. I said that in an abstract way, but let me give you a little bit more about the internal process.

There is a group of the assistant directors. They comprise the MREFC, Major Research Equipment Facilities Construction panel. It is their responsibility to then look at any proposal that comes in for a facility, some infrastructure, to be supported through that account. The first question is always what is the science that is going to be advanced? What they ask, too, what is the level of community interest, input? And now, how will the operational cost be met if we put this facility in place?

Thanks very much to the National Science Board we have got this process that also asks when, and what would be the possible off-ramps? Because you could start something that it might turn out should not go all the way through to completion of construction or operation. There must be possibilities then for saying this is where, if these conditions are not met, we will not continue to invest the federal dollars in the activity.

I can give you more and would love to give you more of how that process, how it is designed, how it all operates, and then what are the kinds of conditions, what are the kinds of analyses undertaken throughout to make sure that the investment in facilities, those investments do in fact produce the activities that facilitate the science and engineering for that is what the facilities are about.

Mr. SCHIFF. And I do not know if you are able to do this right here, and if not we can request it maybe as a follow up, but can you give us examples of particular cases where you found that the facility was not producing the science expected and therefore the program was curtailed? Or where it was doing better than anticipated and the investment was augmented?

Dr. MARRETT. There are lots of them. But one I will use from one of my colleagues just describing the other day, it was a computer science large infrastructure project. And after looking carefully at whether or not it met all the criteria, that part of the Foundation decided it was not a prime candidate for a large infusion through the MREFC process. And in fact they did some things on a much smaller scale, have now learned from that, and said it would have been almost foolhardy to move forward with a very big project that just did not warrant that kind of investment. We do have addi-

tional examples of activities. Even in the 2015 request you will see that the Network for Earthquake Engineering simulation facility, we are proposing to downsize that program. Because there was an external review that said we probably had made some major investments, but it could be reduced in size and scope now. And so we do that on a very regular basis. And again I would say often with the assistance of the National Science Board.

Mr. SCHIFF. Okay, doctor. And now what happened before that inflationary moment?

Dr. MARRETT. Well, can we get back to you on that?

Mr. SCHIFF. Yes, absolutely, absolutely. Thank you, Mr. Chairman. I yield back.

Mr. WOLF. Thank you, Mr. Schiff. Mr. Fattah, do you want to take—

Mr. FATTAH. No, I know that we have to conclude this at some point. But I do want to take a minute, Mr. Chairman, as the ranking member and just recognize a friend of mine who is here visiting the committee today. Kim Neely, who is with the American Political Science Association. Welcome, and I yield back, Mr. Chairman.

Mr. WOLF. Okay, thank you. We are going to have votes, but I am going to come back. I think everyone else has to go home, but I live here. So we will go—

Mr. FATTAH. Well no, Mr. Chairman, I want you to know that your colleague to your right, and he is to your right politically, is holding a hearing of the Veteran Affairs Appropriations Subcommittee at 1:00.

Mr. WOLF. Oh, okay.

Mr. FATTAH. So we are actually going to be working. So I do not want anyone to think that we get a chance to go home. We are going to be dealing with the Veteran Affairs budget and military construction appropriations process.

K-12 STEM EDUCATION BEST PRACTICES

Mr. WOLF. And Mr. Diaz-Balart, do you want to ask further questions? Okay, great. Thank you. After the Committee asked the NSF to look at best practices in K through 12 STEM education, the agency had the National Research Council examine those practices, make recommendations for improvement, and define some metrics that could be used to track the implementation of these recommendations across the country. The National Center for Science and Engineering Statistics is supposed to play a major role in the collection, dissemination, and analysis of the data for those metrics. Will any part of the increase requested for the Center support that effort? And is the Center still on track to collect data on all 14 metrics by 2019?

Dr. MARRETT. Yes. For 2015 there is the collaboration between the National Center for Science and Engineering Statistics, and the Directorate for Education and Human Resources for collecting, for determining what are the best indicators and metrics that ought to be used with the idea that those will be incorporated into Science and Engineering Indicators. Thus, those two parts of the organization are completely on track for moving towards the kinds of improved metrics that you had asked about and that we certainly are incorporating. And you are right, these come out of the whole dis-

cussion of best practices for effective schools that are so important for the nation.

Mr. WOLF. After the release of the 2011 report on best practices in K through 12 STEM education, NSF began to execute a dissemination strategy that would bring the report to as many education policy makers and practitioners as possible. I understand these dissemination activities are still underway. Can you provide us with an update on where and how NSF will be disseminating the report and its findings in fiscal years 2014 and 2015? For instance, if this were 100 percent of the people that should find out about it, and I think that is everyone in education in that area, how many do you think have found out about it?

Dr. MARRETT. I cannot tell you how many have found out about it, but I can tell you what we are doing to try to have all of those who should know have access. Among the things that we have done, we have had seven workshops across the nation. And there is a 12th workshop that is coming up in May of this year with the theme of middle level skills. So that is one of the things that we have done.

We have also had a website that already makes those resources available. And if you want a few of the statistics about this, there have been over 48,000 unique users to this website. There have been 10,000 who have accessed the resources page from the website. And the National Research Council, the partner in all of this, reports that 5,000 individuals have accessed this report online. We then have indications of a great deal of interest.

We are also doing a number of bulletins and briefs to emphasize the research-to-practice issue, which I know was very much of a concern to you. All of those grow out of this interest in the matter of effective schools.

STEM EDUCATION ACHIEVEMENT: GLOBAL COMPARISON

Mr. WOLF. Now how do we compare to China on test scores in math, science, physics, chemistry, biology? What are the comparisons between China versus the U.S., ten years ago, today, and the future? And I am using China, but you could throw in a few others. But I think China is going to be the big competitor. I just caught a radio report, and they asked people who they thought the dominant power of the future would be. I forget the percentage, but it seemed like a majority were saying China. And so where are we on those figures?

Dr. MARRETT. In the math and science arena——

Mr. WOLF. Math and science——

Dr. MARRETT. Yes, in math and science. Actually, the nations that the U.S. is usually compared, where we do not do well, are Singapore and Japan. That those, and often it is Finland that does extremely well in the tests. Now one of the arguments made is that we have a different population in that we often have more of the students taking these tests than sometimes will happen in some other countries. So the test is more dispersed across the population. But nonetheless it is also a consequence of the level of concentration of the effort, the emphasis that one places. When those who are critical of what takes place in some other parts of the world criticize it for being very much focused on memorization and not

necessarily in understanding the basic concepts, this is again, we still, we do not think that is completely satisfactory. Because there can be, there are still great examples from elsewhere, and we do work very collaboratively. In fact, again, I am sure my colleague Dr. Ferrini-Mundy will be more than pleased to provide you additional data on what we know about the international comparisons.

Mr. WOLF. Where do we fall in the United States? When you say Singapore, Finland, where do we fall in the math and science and engineering compared to those countries?

Dr. MARRETT. Do you have—

Mr. FATTAH. Not good news, Mr. Chairman.

Dr. FERRINI-MUNDY [continuing]. No, but on limited tests, tests that can only cover so much content, and various kinds of tests, and again compared to the Asian countries, I think only recently has China been a participant in some of these international studies. So to develop trends will take a little bit of time.

Mr. WOLF. Okay. How about other than China, then?

Dr. MARRETT. That is where I said, places—

Dr. FERRINI-MUNDY. Yes, we are in the middle of the entire pack. We are not—

Mr. WOLF. But where were we in 1960 and 1970 and 1980?

Dr. MARRETT. Your question is are we doing worse now—

Mr. WOLF. Yes.

Mr. FATTAH. Can I, if the chairman would yield, we are doing worse than we used to be doing, right? Relatively speaking? And we are in the, you know, middle of the pack in math and science. And it is worse than even Dr. Harris' analysis about spending. Because when you look at our, look at the programs that we are going to fund through the National Science Foundation, the graduate education programs. We have the best programs in the world. But when you go to look at who is actually seeking the degree in the terminal discipline, in the hard sciences at these American universities in Pennsylvania and in Texas and so forth, they are not American students. These are students who not only are they not American students, whereas in the past they may not have been American students but they intended to stay here in America, build businesses here, build careers here, many of these students are now here and their intentions are not to stay here. And that is they are here to get a degree, and they are going back to compete against us in their homeland.

And so the situation is worse than even the numbers would suggest because we have a problem at the top end of the scale. So we can create the best engineering program in the world at the University of Pennsylvania, or the University of Texas, you know, but if we do not get American students, or students who are going to pursue a degree and stay in America and build businesses here, then it is a, it is a lose-lose proposition for us.

Dr. MARRETT. There is the other part of it. If you take the pre-college students, and just about any of the international tests, we have got a population of students who outperform others in the world. The problem is, that is a small segment. And that in other countries, far more of their students are doing well than is the case in the U.S. This is quite interesting because after the Sputnik period generated all of this interest in performance, but it was for a

small group. Now that we are saying we need the talents from across all segments of the population there is this concern about why are we falling behind in serving the entire population well? So this complements what Mr. Fattah, who happens to be an expert on this topic, I know, what he said about the graduate, and the graduate world.

STEM EDUCATION ACHIEVEMENT GAP

Mr. WOLF. Well, you are not the Secretary of Education, and we are not trying to blame the National Science Foundation. I was just trying to find out. A number of my kids are in education, and one of my daughters works for the Broad Foundation. And I read a lot of stuff on education. I think we are falling behind. It is an issue that really does not become a Republican issue or a Democratic issue. There is just something wrong. People can spin it in different ways. My wife showed me this quote, and I did not know I was going to use it. I took it in for another reason. It is from Lincoln, and I tried to verify if it was accurate. But it says, "a child is a person who is going to carry on what you have started. He is going to sit where you are sitting and when you are gone he is going to tend those things you think are important. You may adopt all the policies you please but how they are carried on depends on him or her. He or she will assume control of your cities, states, and nations. He or she are going to move in and take over your churches, your schools, your universities, and businesses. All of your books are going to be judged, praised, or condemned by him or her. The fate of humanity is on their hands."

One of my kids helped run a school in the inner city. It is a Christian school. It is in one of the roughest neighborhoods in this town that we are in. Those kids are excelling and yet you have other kids in certain places who are not. Something has got to be done. And so I thought you were more objective than me. I think whatever the administration, whether it be the Bush administration or the Obama administration, they all want to kind of spin it in a way. But it does seem that there is a problem. And that is why we had asked that this STEM report be conducted, and that is why I was always disappointed in Dr. Bement. I mean, he just kind of let this thing go. You have done a good job. But if Abraham Lincoln said this, and I think he is right, then I think the country is in trouble.

Dr. MARRETT. Well I would, if you do not mind a little comment on there, we would appreciate the kind of engagement coming from you, from this committee. But it is of a great deal of interest. And again, I do not want to understate how important this is for the National Science Foundation. And in much, and when we talk about our research, that research is sometimes trying to unravel the sets of issues to understand what leads to the matters of performance by some, performance under certain kinds of conditions. To link back to the neuroscience area, for example, someone was talking recently about the research on it is something like cognitive load. That when some students have so many other things going on, it is hard to spend the time then on the kind of academic enterprise. That is why these other sorts of conditions seem to play into the very educational world. And that is why I say at the National

Science Foundation we see our task as bringing together the various sciences to try to understand the sets of issues. And then to be able to propose to you and others, who are in the policy realm, the kinds of things you might well consider.

FEDERAL STEM COORDINATION

Mr. WOLF. The administration has not repropoed any major interagency funding shifts between STEM programs. However, they remain committed to the idea of NSF, the Department of Education, and the Smithsonian acting as lead agencies for all government STEM efforts. OMB has stated that other agencies will be expected to, "jointly administer or otherwise better coordinate their activities with those of the three lead agencies in fiscal year 2015." What does this mean in practical terms for the NSF? Do you expect to be jointly administering programs with other agencies next year?

Dr. MARRETT. No, we do not. The way we interpret, and this is from the conversations with OMB and OSTP, we see this as being consistent with the report from the Committee on STEM Education. The COSTEM report works a lot around questions of collaboration, of communication. And growing out of that has been exactly the kind of, the sets of discussions. So NSF stays very involved with the other agencies around the matters of undergraduate education and graduate support, for student and graduate support. That does not mean that we are administering all of those programs. It is saying, let us be the place in which there can be these shared discussions about how to improve the things that we are undertaking.

We do the same thing in collaboration with the Department of Education. The Department of Education has the larger mandate when it comes to K through 12. We want to work collaboratively there. But that does not mean that money was moved from one agency to another to enhance this kind of communication. That is the interpretation we have, for what it means to be in the lead. Leading for collaboration, but not leading for control of resources.

Mr. WOLF. Okay. We had asked the Science Office at the White House to have a one stop STEM website and they have not done that. I wonder if NSF should be the—

Dr. MARRETT. Oh, I did not hear the—

Mr. WOLF. A report just came in this morning that we were referencing.

Dr. MARRETT. All right, I see.

Mr. WOLF. It has implications for NSF, so why do we not look at the report and then—

Dr. MARRETT. Please.

Mr. WOLF. We have been asking them to have a one stop place that people could go to see consolidated. STEM resources, and the thought was maybe NSF should be the place to host it. But let me see what the report says. It just came in. Mr. Schiff, or Fattah, or Mr. Culberson? Sure, you can go ahead.

POLAR ICEBREAKING

Mr. CULBERSON. Thank you. If I could, Dr. Marrett, I wanted to ask about the Ice Breaker Program. Are you all still responsible for, or able to get that out of your hands so that is not devouring

your resources? Has the Coast Guard taken responsibility for the refurbishing or rebuilding of our ice breaker fleet?

Dr. MARRETT. Yes. At a recent meeting of the Antarctic Research Policy Committee, there was a representative there from the Coast Guard who asked that the agencies all identify what their needs would be so that the Coast Guard could respond much more effectively to what takes place. It is clear that NSF cannot manage the icebreaker issue alone. But it is also clear that a number of other agencies cannot. So we are working collaboratively to determine what is going to be the best way to address that.

Mr. CULBERSON. But it is the Coast Guard? It is the Coast Guard's responsibility?

Dr. MARRETT. It is Coast Guard.

Mr. CULBERSON. Okay, terrific. And you are just a customer?

Dr. MARRETT. Yes.

Mr. CULBERSON. Now are they wind up do you think from what you can tell leasing ice breakers for you to use?

Dr. MARRETT. Right now we are——

Mr. CULBERSON. You are leasing them now.

Dr. MARRETT. Yes.

Mr. CULBERSON. Right.

Dr. MARRETT. We are examining a number of different kinds of options. And so leasing has been the most reasonable for us right now because, again, we just do not have the resources to talk about having, building and operating an icebreaker.

Mr. CULBERSON. I mentioned it because during the Bush administration they attempted to move that entire responsibility into your lap and it just bothered me terribly. Because it is so important that we give you the money you need to do the peer reviewed, merit based research that you mentioned without having your resources devoured by replacing an ancient ice breaking fleet. I am glad that Coast Guard has got responsibility for it. Thank you, Mr. Chairman.

FUTURE NSF: AGENCY RELOCATION

Mr. WOLF. The NSF fiscal year 2015 request contains the first major infusion of money associated with the NSF's new headquarters facility. In fact, these costs constitute about 40 percent of the total increase requested for NSF. Given that occupancy is still several years away, do you expect that large headquarters related requests will be necessary in each of the next few budget cycles? And what is the total estimated cost across all fiscal years associated with moving to the new headquarters facility?

Dr. MARRETT. Our estimate right now for three years, that is 2014, 2015, and 2016, is \$80 million for NSF. \$20 million in 2014, and we do not have the final figures on that, \$30 million in 2015, and \$30 million in 2016. Now the reason for this is that under the GSA guidelines an agency is responsible for the build out of whatever is going to be there. So you have got to furnish, you have got to make sure you have got the IT equipment that would be there. And that is what the estimated cost for those is actually above \$80 million. But what GSA negotiated with the developer was the developer would put in \$35 million to help defray some of the cost to NSF. But that is where we are right now.

And so you are right with reference to the budget request. When one sees the Agency Operations and Award Management, or AOAM account, most of that is for the cost of the building. We said, yes, when we are talking about moving in the end of 2016, the beginning of 2017, that might seem to be quite some time off. But you have got to make commitments earlier on to the developer to have those plans in place, and to have the kind of construction that we are talking about. So there are some figures that we are still trying to get clarity on. But that is the estimate right now.

Mr. WOLF. So the budget is not really what the budget appears to be. Because if you add that in or take that out, the numbers change dramatically for your programs?

Dr. MARRETT. We do not anticipate those numbers changing dramatically.

Mr. WOLF. You—

Dr. MARRETT. No. There is a group that I put in place that is called the Relocation Executive Advisory Group that continues to monitor, as closely as possible, the kinds of figures we are talking about and making some decisions to keep those figures as low as possible.

Mr. WOLF. A few months ago your staff notified us that a significant funding requirement for security related upgrades at the new headquarters may hit NSF during fiscal year 2014, but these costs were not addressed in your most recent spending plan. When will these costs be determined, and how does the NSF expect to deal with them midway through the fiscal year?

Dr. MARRETT. We expect to have those costs on security in a couple of weeks. Because they required a level of decision making on it. The question was at what level did we think our security needed to be? And that is what is being worked out. And that will determine what those costs will be. But that will be in a couple of weeks.

Mr. WOLF. Do you think they will be significant?

Dr. MARRETT. No. The costs? No. We are trying, that is why, again I said because we are not like a facility that has to be protecting animals. There are certain other things, too. So we do not see ourselves as being as much of a risk as might be certain other kinds of facilities. And that is what will drive the security costs.

ACCOUNTABILITY AND TRANSPARENCY IN GRANT AWARDS

Mr. WOLF. At this hearing last year we discussed the tendency for individual NSF grants to be held up as examples of wasteful or frivolous government spending. What steps have you taken since that time to improve accountability within the agency for making funding decisions that are well aligned with national interests? How do those steps apply to decision making at both the micro and the macro level? Because if you make a grant that is just ridiculed—shrimp walking on a treadmill versus something with regard to what Mr. Fattah was talking about with the brain—it then hurts up here insofar as defending your funding while we are in a deficit time.

Dr. MARRETT. Yes. Well I laid out quite some time ago both to members of this committee and other committees a plan that we were putting in place that I have called transparency and account-

ability. What it does is to make every level of the organization responsible for the awards that are made. We still will be following the merit review system, but the award should fit into a larger portfolio, for one thing. And we do pay attention to titles and abstracts. Those are the instructions I have just gotten back to all of our staff to know about. So those are some of the actions that we are taking.

Mr. WOLF. All right, thank you. How are you improving the ability of the agency and its grantees to communicate clearly the merit of particular research projects—

Dr. MARRETT. Well actually—

Mr. WOLF [continuing]. And their potential value, too?

Dr. MARRETT. Yes. That is already supposed to be there. And what we had discovered is that some people are better than others in being able to be clear about it. It is not their task, it is the task of NSF. Because once we make an award, the abstract, the description, the title is something we can decide how that is going to be done. So, that is a part of what we are now engaged with our program officers about. It is their responsibility working with the larger community to get PIs to be as clear about these communications as possible. But if that is not all that clear, then actions have to be taken within the Foundation.

Mr. WOLF. But it ought not be a spin, either.

Dr. MARRETT. Not at all.

Mr. WOLF. It ought to be honest and authentic, with integrity so that you do not put something out there and then when you dig deeper you find that it is really not that. It has to be honest.

Dr. MARRETT. Exactly. As a matter of fact there is another part to this in that sometimes this pressure, the interest of researchers in trying to make their ideas as understandable as possible might come up with something that is cute but not descriptive. So we have to make sure that there is no spin to this. It has got to be about how you provide it in ways that the public can understand and grasp why you are doing this.

Mr. FATTAH. Chairman? If the chairman would yield for one second? One of the challenges here is that I think, is I know that we have some need to have the marketing correct. But, you know, we have to be careful not to dumb down this process. I mean, part of what we know about basic scientific research is that oftentimes major discoveries come not as a direct result of what was originally proposed, right? So, you know, there are millions of Americans who avoid unnecessary surgery or have better surgery because of MRIs. But the original research had to look, they were looking for pockets in clouds. I mean, it had nothing to do with coming up with better imagines, you know, for medical purposes.

So I think that what we have to do is we have to make a stronger case about basic scientific research and how it later on creates major breakthroughs so that we get the public to support the notion that scientific investigation on its own is a worthy public investment.

Mr. WOLF. No, I agree.

Mr. FATTAH. I yield back.

REVIEW OF FACILITY MANAGEMENT POLICIES AND PROCEDURES

Mr. WOLF. Before he departed the agency and moved to Pennsylvania, Dr. Suresh ordered a major review of agency policies and procedures on the management of large research facilities. He hoped that this review would lead to the eventual resolution of longstanding disputes between the agency and the Inspector General about construction contingency funding and cost surveillance in large cooperative agreements. Since his departure, however, we have heard very little about either the review itself or any policy changes resulting from it. What is the status of the review?

Dr. MARRETT. That review actually was not addressed to some. It was a useful review about some things and the way in which large facilities management might take place. But some of the things that were very specific there about contingency, and how contingency, that was really never a part of that report to start with. Why you have not heard anything is that this discussion about contingency has been led by OMB. And OMB has rather recently issued the guidance for all agencies. We are then looking at what that interpretation will be. And we will be glad to get back to you. But I do need to say that while the report was important for certain processes it did not address all of the kinds of things that I think you are referring to. And one of them had to do with how you determine contingency cost for large projects.

[The information follows:]

The NSF continues to work with the Office of Inspector General (OIG) to resolve the issues of construction contingency and cost surveillance. The resolution of these audit findings are still in process.

Since the issuance of these audit findings, the Office of Management and Budget (OMB) has clarified their position on the usage of contingency in assistance agreements. On August 21, 2013, OMB responded to a request from Senator Grassley on this topic and stated, "... Section J. 11 of Circular A-21 and Attachment B, Section 9, of Circular A-122 allow for budgeting and making obligations for contingency when establishing, and implementing, a cooperative agreement." Moreover, in its *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards; Final Rule*, published on December 26, 2013, OMB states that "Section 200.433 Contingency Provisions clarifies the circumstances under which contingency costs may be included in Federal awards" (78 FR 78593) and that, "The [Council on Financial Assistance Reform] reviewed the language, and concluded that it does provide sufficient controls to Federal agencies to manage Federal awards." (78 FR 78602)

NSF expects that this language clarifying the allowance for budgeting and making obligations for contingency in cooperative agreements will resolve this longstanding disagreement on the interpretation of these provisions.

NSF solicits, reviews, awards and manages its portfolio of cooperative agreements, including those funded through the MREFC account, using robust end-to-end financial and administrative practices. These practices are consistent with the established legal, regulatory, and administrative framework for federal financial assistance agreements. This legal and regulatory framework includes the Federal Grant and Cooperative Agreement Act, OMB Circulars and Common Rule as incorporated into the Code of Federal Regulations, and NSF's compendium of financial assistance policy and procedures. Nonetheless, management is consistently seeking to improve its practices and has proposed corrective actions in response to the OIG's audits that will improve the Foundation's cost surveillance of large cooperative agreements.

NSF continues to participate in the audit resolution process and looks forward to a rapid disposition of this issue.

Mr. WOLF. And how will this go down with your IG?

Dr. MARRETT. How does that—

Mr. WOLF. How will your IG view this? I mean there seemed to be some tension between—

Dr. MARRETT. Yes. That is where we are, that is part of what we are asking now, if this is the interpretation, that has come from OMB, that as we see that interpretation, it says the NSF processes are consistent with the OMB guidance. We are working with our IG then to see if that is acceptable, and if the interpretations are the same there. We are in discussions with the IG over those meetings, yes.

POST-AWARD MONITORING ACTIVITIES

Mr. WOLF. On grants management, the Committee was concerned that NSF's grant monitoring efforts are undersized relative to the number of grants that the agency is responsible for. As one point of comparison, NSF typically conducts about 30 grantee site visits and 120 desk reviews each year while the Department of Justice Office of Justice Programs, an organization that is much, much smaller than NSF, conducts over 200 grantee site visits and thousands of desk reviews each year. Do you believe that NSF has sufficient resources dedicated to overseeing its grant portfolio and ensuring that all funds are being used effectively and appropriately?

Dr. MARRETT. It is tempting to say that one of the differences between Justice, the community the Justice Department works with, and our community is we have got honest people. We do not have to monitor as closely. But I will not say that.

Mr. WOLF. Well they are usually dealing with localities, though.

Dr. MARRETT. Instead—

Mr. WOLF. They are not dealing with the criminal population.

Dr. MARRETT. Yes. We have a number of processes. One of them is a risk-based process to start with. We know what the risks are based on the kind of awardee and the kind of award. And that helps us determine which ones require more monitoring than others. And so there are several stages to this process that we have in place. While it might seem as if we do not have sufficient staff to do these individual site visits, that does not mean that we are not keeping tabs on what is going on.

In many of the cases, the institutions where we have awards, also have awards from other federal agencies. And sometimes that is where the responsibility for the overarching monitoring on behalf of the federal government would take place. But as I said, I am more than willing to provide more information about the detailed processes we use to monitor, to oversee the awards that we make.

[The information follows:]

NSF utilizes efficient, risk-based, cost-effective, and innovative methods to take optimal advantage of our finite resources available for grants management and related tasks. NSF's grants management and related monitoring activities extend far beyond 30 visits and covers the entire NSF award portfolio of more than 40,000 active awards.

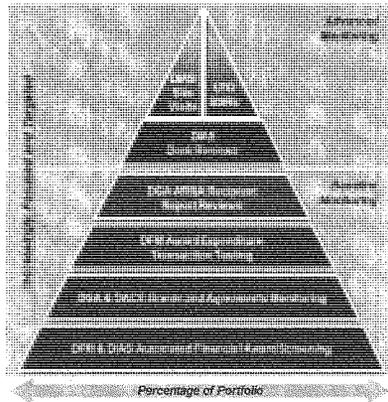
NSF's approach includes a combination of forward-looking measures developed to assess an institution's grant management capacity, targeted monitoring efforts designed to evaluate specific areas of concern, and business assistance to help institutions improve their capacity to more effectively manage awards.

BFA's award monitoring approach is comprised of **three interrelated areas of activity**:

- **Annual Risk Assessment** – NSF conducts an annual risk assessment of the awards and awardee institutions across the award portfolio to determine the comparative level of risk for its grantees. We use a dynamic risk model, that takes both institutional and individual award characteristics into account, and it informs our decision making insofar as how to target advanced monitoring, as distinguished from routine financial and administrative interaction. This assessment assists NSF in making decisions about the type of monitoring activity to implement for each institution receiving NSF funding. It is designed to enable BFA management to focus its finite monitoring resources on awardees administering higher risk awards according to a risk profile. As of June 30, 2013, the total value of NSF-funded active research to “promote the progress of science; to advance the national health, prosperity, and welfare; and to secure national defense” was approximately \$28.8 billion with 42,544 awards issued to 2,290 institutions. NSF's awardees include academic institutions, non-profit organizations, for-profit organizations, community colleges, school districts, tribal colleges, and foreign institutions or international organizations. Academic institutions, non-profit organizations, and for-profit organizations received approximately 91 percent of NSF grants and cooperative agreements. The NSF portfolio is relatively stable, primarily established institutions with internal control structures that are tested annually via single audits. Many of NSF's grantees receive more than one NSF award, as well as awards from other federal agencies. Although it issues awards to 2,290 institutions, NSF is the cognizant agency for 84 awardees, awardees for which NSF is the primary source of federal funds. NSF targets its post-award monitoring activities on the institutions assessed to be managing high- and average- risk award portfolios, which consist of 30 percent of NSF awardee organizations that administer 85 percent of the total NSF award portfolio dollars (see the “advanced monitoring” segment of the graphic below).

- Baseline Monitoring** – NSF conducts a comprehensive array of post-award administration activities. Examples include the processing of cash requests and period of performance extensions. Baseline monitoring, executed in the course of post-award administration, seeks to verify that awardee institutions implement awards in compliance with federal regulations and the terms and conditions of NSF award agreements. Examples include review and approval of post-award requests/actions from awardees, investigating excess cash on hand, and evaluating financial adjustments to closed awards. Baseline monitoring, conducted on all grants and agreements, results in the identification of exceptions and potential issues that require immediate attention or that may require further scrutiny through advanced monitoring.
- Advanced Monitoring** – The NSF advanced monitoring effort is a structured, coordinated strategy for identifying and mitigating a broad array of risks. Those institutions managing the highest risk awards are subject to advanced monitoring activities designed, in part, to provide reasonable assurance of the adequacy of policies, processes, and systems (i.e., general management, accounting) to properly manage federal funds. Advanced monitoring activities include Desk Reviews, Site Visits, and Business Systems Reviews (BSR) of NSF's large facilities in construction and operation. In FY 2012, NSF adapted the proven advanced monitoring site visit methodology to pilot a virtual site visit approach for selected awardees. NSF was able to conduct comprehensive and cost effective reviews of the awardee's award administration policies, procedures, and practices by utilizing virtual conferencing tools in combination with secure, external SharePoint sites to facilitate the transfer of documents. When deficiencies are identified, NSF requires grantee institutions to develop acceptable corrective action plans, which become potential targets of subsequent monitoring activities. In FY 2013, advanced monitoring activities included 30 Site Visits (including on-site and virtual), 105 Desk Reviews, and four Large Facility Business System Reviews. In FY 2014, it is anticipated that 30 Site Visits (including on-site and virtual), 105-110 Desk Reviews, and three Large Facility Business System Reviews will be conducted.

NSF Post-Award Monitoring Activities



ARRA – American Recovery & Reinvestment Act

BSR – Business System Reviews

DACS – Division of Acquisition & Cooperative Support

DFM – Division of Financial Management

DGA – Division of Grants & Agreements

DIA5 – Division of Institution & Award Support

LFO – Large Facilities Office

External audits of institutions receiving NSF funds provide additional information on accountability and transparency; ensure that programs and business functions are operating efficiently and effectively; and confirm that institutions are spending federal funds appropriately and for intended purposes. In FY 2013, external audits of organizations were required of any institution receiving a minimum of \$500,000 in federal funds annually under OMB Circular A-133. The NSF OIG issues these audits to NSF Management for resolution when NSF funds are involved. In addition, the OIG selects a number of grantee institutions to audit on an annual basis. Resolution of findings from these reports can identify cost disallowances, system deficiencies, internal control weaknesses, noncompliance issues, and areas for

improving operations. Implementation of requisite corrective action plans lead to proper management of federal funds.

This combination of post-award monitoring activities supplements other NSF award administration activities. For example, NSF reviews the financial management capabilities of new and potential awardees prior to issuing an award, and the Office of the Inspector General (OIG) conducts audits on a variety of issues related to awardees' management practices. BFA also reviews the Negotiated Indirect Cost Rate Agreement (NICRA) proposals for awardees for which it is cognizant. For specific awards, NSF reviews technical and cost proposals prior to making the award, as well as technical and financial reports and other deliverables after issuance of the award. This combination of activities provides internal checks throughout the grant's lifecycle, facilitating both the administration and monitoring of awards and appropriate monitoring of institutions receiving those awards.

Mr. WOLF. Okay. Please, do that. Your budget this year proposes \$4.5 million for increasing staffing. Will any of these new positions be dedicated to post-award oversight?

Dr. MARRETT. We were directed to make sure that we had sufficient staffing for oversight. But most of the increase that you see there is really not a significant kind of increase. We still do have the problem of how do we manage the number of activities that we have. But yes, some of that will be for the area that you are talking about. And again, we will get you more of the specific information on how those allocations and in terms of the area that you are asking about.

[The information follows:]

The FY 2015 Request does not specifically provide for new positions for post-award monitoring. It does support FTE increases for the related areas of Proposal Management Efficiencies and the NSF Evaluation and Assessment Capability, both of which will provide resources that are useful in program management and oversight generally.

COST OF INTERGOVERNMENTAL PERSONNEL ACT EMPLOYEES

Mr. WOLF. Okay, thank you. For some reason they said there were going to be votes, but there are not. Both the Committee and your IG have registered concerns about NFS's costs for temporarily hiring employees through the Intergovernmental Personnel Act, that is the IPA. The IPA employees cost NSF millions of dollars more than the equivalent costs of civil servants each year, and the rate of growth of IPA costs is much higher than for civil servants. What steps are you taking to keep IPA costs under control?

Dr. MARRETT. We are doing a number of things to keep the costs under control. In some cases they could be somewhat detrimental to us. For example, as the travel related costs, we have got to keep those down. That makes for a real problem when we bring people from the West Coast, and they have only got a certain number of days that they can travel. So we are looking at that saying, we have got to have some things that will be reasonable.

We are also working on trying to get more of the institutions, from which the IPAs come, to engage in cost sharing. That is an expectation. And some institutions have been doing this and doing it quite well. We are making all of these strides because we see the program itself as so significant. We do not want to lose the possibilities of bringing some of the best people in the nation to NSF to help with all the activities that are underway.

UNEXPENDED RECOVERY ACT FUNDS

Mr. WOLF. More than five years after the enactment of the Recovery Act, NSF still has nearly \$200 million of unspent stimulus funding, including nearly \$17 million that is tied to projects that are zero percent complete. Why should these funds remain available for grantees rather than being reclaimed and returned to the Treasury?

Dr. MARRETT. Those are all obligated funds. The ones that have not been spent out completely were for several reasons that have been approved. One of the reasons is that some of them were CAREER grants and those are five-years in duration, and are longer awards. So they were not going to be spent out within that limited

timeframe. There were some other instances in which environmental issues had to be resolved before all the expenditures could be made. We got OMB approval for anything where there needed to be something past the deadline for the expenditures. But everything is obligated. These are not funds to be pulled back for other uses.

Mr. WOLF. When can we expect all the stimulus expenditures to have been spent?

Dr. MARRETT. In a, it may be, is it a couple of years? We might in about two years—

Mr. WOLF. Two years?

Dr. MARRETT [continuing]. Because of the way that some of the programs are set up.

Mr. WOLF. Okay. Mr. Fattah, if you have last profound comment?

Mr. FATTAH. Thank you, and I thank the Board Chairman and all of the staff at the Foundation. And I thank the chairman, and there will be a lot of time but we can never do it too much. You know, the chairman is going to be retiring. And I do think it is important that we continue to put on the record his extraordinary leadership. Even though he is on the other team. But he has been a steward in terms of support of science and the Foundation in particular. So I do not want to miss that opportunity. Thank you, Mr. Chairman. And I yield back.

Mr. WOLF. Thank you, Mr. Fattah. Mr. Culberson, do you have anything? Well, thank you. If you could get us that information on international comparisons, I may send something out or do something on the floor to sort of show where we are and to make the case that we probably need to do more. And you could certainly help us with education, so do the same thing in math and engineering education so we get some sense of maybe ten years ago to where we are, and from where we are to ten years from now. If you go to 2022, that is fine, but 2022 or 2024 would be good. Anyway, thank you very much. I appreciate it. Please give my best to Dr. Suresh if you talk to him.

Dr. MARRETT. I certainly will.

Mr. WOLF. Thank you, hearing adjourned.

UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Appropriations
Subcommittee on Commerce, Justice, Science, and Related Agencies
Hearing on
National Science Foundation FY 15 Budget Request
March 27, 2014
Dr. Cora Marrett, Acting Director, National Science Foundation
Questions for the Record Submitted by
Frank R. Wolf

Education and Human Resources (EHR) Programs

Question 1. NSF's recent budget requests have placed a lot of emphasis on graduate-level fellowship programs, with much smaller increases requested for traineeships. Why has NSF chosen to focus its resources in this way? How do you respond to critics who believe that fellowship and traineeship opportunities need to be better balanced with one another in your budget?

Answer: NSF recognizes the importance of appropriately balancing its investments in graduate education. As is noted in the FY 2015 Request, the agency is addressing this through the development of a five year strategic plan for its investments in graduate students and graduate education. This plan builds on four related efforts: 1) the recommendations of the National Science and Technology Council's Committee on Science, Technology, Engineering, and Mathematics Education (Co-STEM) 5-Year Strategic Plan¹ 2) on-going interagency discussions about leveraging assets; 3) recent national reports on graduate education^{2,3,4,5} and 4) NSF-wide efforts to ensure that its many forms of investment in graduate education form a coherent agency strategy. A key driver of this effort is the recognition that graduate training in STEM must continue to evolve in order to provide a supply of scientists and engineers who not only meet the needs of the emerging STEM enterprise, but who have the knowledge, skills, and preparation to advance it, both within and outside of academia.

Question 2. In fiscal year 2014, NSF unsuccessfully proposed to consolidate 3 of its undergraduate STEM programs into a new initiative called Catalyzing Advances in Undergraduate STEM Education (CAUSE). Now the fiscal year 2015 request consolidates those same 3 programs into a new initiative called Improving Undergraduate STEM Education (IUSE). What is the difference between last year's CAUSE initiative and this year's IUSE proposal?

Answer: As a part of continuing efforts to stimulate innovations in undergraduate education, in FY 2014 NSF merged three undergraduate STEM education programs – Transforming

¹ National Science and Technology Council, Committee on STEM Education (2013) *Federal Science, Technology, Engineering and Mathematics (STEM) 5-Year Strategic Plan*
www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf.

² Council of Graduate Schools (2012) *Pathways through Graduate School and Into Careers*,
http://pathwaysreport.org/rsc/pdf/19089_PathwaysRept_Links.pdf

³ National Institutes of Health (2012) *Biomedical Research Workforce Working Group Report*,
http://acd.od.nih.gov/biomedical_research_wgreport.pdf

⁴ American Chemical Society (2012) *Advancing Graduate Education in the Chemical Sciences*,
www.acs.org/content/dam/acsorg/about/governance/acs-commission-on-graduate-education-summary-report.pdf

⁵ National Research Council (2012) *Research Universities and the Future of America*,
www.federalrelations.wisc.edu/docs/FutureofAmericaU.pdf

Undergraduate Education in STEM (TUES), STEM Talent Enhancement Program (STEP), and Widening Implementation and Dissemination of Evidence-based Reforms (WIDER) – into an umbrella program description, Improving Undergraduate STEM Education (IUSE). IUSE, an NSF program, provides grantees with greater flexibility to integrate multiple approaches to increase attraction to STEM; to increase persistence and retention in STEM of all students; to improve the quality of the undergraduate STEM learning experience; and to prepare both a quality STEM workforce and a STEM literate citizenry. Over the past year, NSF has made considerable progress toward a stronger, more cohesive infrastructure for delivering undergraduate STEM education programs. IUSE provides a core that in fiscal year 2015 will lead to greater effectiveness, efficiency, and impact. The coherency of IUSE supports the development of common metrics and evaluation to measure the impact of NSF awards on undergraduate education.

In the fiscal year 2014 budget, NSF's request to integrate undergraduate STEM programs was presented in a broader cross-government context of Catalyzing Advances in Undergraduate STEM Education (CAUSE). In this broader context, undergraduate programs across federal agencies were proposed for reorganization. Respecting the request of Congress, this cross-government reorganization did not occur as originally proposed. NSF has continued with internal efforts, however, notably the integration of these three undergraduate programs at NSF through the IUSE program description.

Question 3. NSF's budget requests imply that the agency thinks the CyberCorps: Scholarships for Service program has too much money. Are there significant differences in the annual funding rates for this program versus other major NSF programs or the agency-wide average? Are there significant differences in NSF's ability to efficiently obligate funding for CyberCorps versus other major NSF programs?

Answer: The budget requests for the CyberCorps: Scholarships for Service (SFS) program have been in keeping with an assessment of the growth of the field and the capacity of the training community so that highly meritorious programs could be identified and funded.

NSF has been asked by Congress to enhance funds available for the program by an additional \$20.0 million in each of fiscal years 2012, 2013, and 2014. As a result, the additional projects funded have expanded the original SFS mandate, which called for maintaining 300 students on SFS scholarships, to the 470 that the program currently supports. It is expected that already-funded projects will increase this number to 600 students during the next few academic years. At the same time, the number of universities offering SFS scholarships increased from 35 in 2011 to 54 in 2014. In FY 2011, the funding rate for the SFS program rose to levels significantly higher than the NSF average (35 percent for SFS vs 22 percent for NSF overall); however, the SFS institutional capacity is now at the point that the SFS funding rate is anticipated to be closer to the NSF average (in FY 2013 the SFS funding rate was 25 percent versus 22 percent for NSF overall).

In keeping with the enhanced capacity that has been developed in the field, the FY2015 NSF budget request for the SFS is \$25.0 million. An additional \$20.0 million is provided through the Administration's Opportunity, Growth, and Security Initiative (OGSI). In FY 2014, \$45.0 million is allocated for SFS.

Number of Awards and Funding Rate

Question 4. The budget request projects that 11,400 awards will be made in fiscal year 2015, an increase of 100 awards over the fiscal year 2014 projection. How is this possible when the request for Research and Related Activities is a decrease and the increase proposed for Education and Human Resources is primarily needed to pay for higher Graduate Research Fellowship stipends?

Answer: In FY 2015 NSF estimates making 11,400 awards, a one percent increase over the 11,300 awards estimated for FY 2014. This increase is due to a combination of additional education grants and a small increase to the percentage of continuing grants in FY 2015. NSF can shift the balance of standard versus continuing awards to increase the overall number of new awards made in a given year in order to mitigate impact to funding rate under scenarios of increasing proposal pressure and/or decreasing funding. Keep in mind, however, that because continuing grants require out-year commitments, they encumber future funding that could otherwise be used to make new awards. Repeatedly increasing the share of continuing grants over a number of years would increase the total 'mortgage' owed and could actually have a detrimental effect on future funding rates if high mortgage levels prevent a sufficient number of new awards from being made.

Question 5. The projected agency-wide funding rate for fiscal year 2015 is 22%, the same as fiscal year 2014. In your opinion, what is a healthy agency-wide funding rate that would indicate sufficient budgetary resources available to all programs?

Answer: Since NSF issues awards based on the availability of funds there is no target or 'healthy' funding rate. The funding rate is determined by a number of factors in addition to the budgetary resources available, such as the number of proposals submitted, the quality of proposals, the size of awards, and the balance between standard awards and continuing awards.

Question 6. Last year, you indicated that NSF was seeking to address the unusually low funding rate in the Engineering Directorate, but the budget request does not appear to do anything to improve it. How does the budget request address the problem of low funding rates in Engineering?

Answer: In a climate of constrained budgets, addressing this issue is quite challenging. Each of the Foundation's research directorates plays an important role in national and emerging priorities worthy of support. The FY 2015 budget request recognizes the importance of balancing these issues. The Directorate for Engineering (ENG) continues to seek innovative ways of addressing this issue, including making some changes in business processes, which has helped increase funding rates. Two engineering research divisions have gone from two annual proposal submission windows to a single submission window and all divisions have revised the focus of their program descriptions. As a result of these changes, the directorate has seen a decrease of over 10 percent in the total number of research proposals received since FY 2010. In addition, ENG achieved a funding rate of 18 percent in FY 2014, equivalent to three other Research & Related Activities directorates. This is an increase of one percentage point over FY 2012 and 3 percentage points over FY 2010 and FY 2011. We will continue to pay close attention to this issue in future fiscal years.

NSF Inflation Factor

Question 7. At the hearing, NSF indicated that it does not calculate or track a research-specific inflation factor similar to NIH's Biomedical Research and Development Price Index. In the absence of an NSF-specific inflation estimate, what was the general inflation factor assumed for fiscal year 2015 in the President's budget request? How does this inflation factor compare to the 1.2% increase requested for NSF?

Answer: NSF does not use an across-the-board inflation factor to formulate its budget requests. However, there may be unique instances where a factor is used for planning purposes, such as for large facilities and MREFC projects. In those instances, NSF uses economic assumptions that are shared across government.

Questions for the Record Submitted by
Jose E. Serrano

Hispanic-Serving Institutions Program

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 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. In addition to report language, the America COMPETES Act, P.L. 110-69 authorized the creation of a Hispanic-Serving Institutions Undergraduate Program at the NSF for \$30 million. Earlier this month, 21 of my colleagues and I sent a letter to President Obama restating our support for the creation of a dedicated HSI STEM program within the NSF and encouraging the Administration to work with Congress as the America COMPETES Act Reauthorization approaches.

Question 1. What is the status of the report? Why has the NSF refused to comply with Congressional instruction?

Answer: The aforementioned HSI report is being drafted and will be submitted by the required deadline of May 17, 2014. NSF will address funding of HSIs through its existing programs in order to meet the specific needs of HSIs, as required by the joint explanatory statement.

**Questions for the Record Submitted by
Michael M. Honda**

Transitioning Innovations from the Lab to the Marketplace

Question 1. Often, startup companies and researchers have trouble transitioning discoveries and inventions from the lab to the market. The NSF Innovation Corps program is purposed with connecting NSF-funded research with the technological, entrepreneurial, and business communities to help bridge this gap between discoveries and downstream technological applications. How do the Innovation Corps and the “Nodes” and “Sites” that NSF supports work with researchers to “build, utilize, and sustain a national innovation ecosystem that augments the development of technologies, products, and processes that benefit the Nation”? How else is the NSF helping researchers transition their innovations from the lab to the marketplace?

Answer: The purpose of NSF I-Corps is to support NSF-funded researchers who, with teams, are interested in transitioning their research out of the lab. I-Corps awards are based on the maturity of the effort (i.e., whether the research is ready to leave the lab), strength of the team, and anticipated market value. The teams selected for I-Corps awards will receive additional support – in the form of mentoring and funding – to accelerate innovation that can attract subsequent third-party funding.

NSF established the **I-Corps Nodes** program to support regional needs for innovation education, infrastructure and research. The interconnected nodes of this network are diverse in research areas, resources, tools, programs, capabilities and geographic locations; while the network has the flexibility to grow or reconfigure, as needs arise.

I-Corps Nodes foster understanding on how to:

- Identify, develop and support promising ideas that can generate value,
- Create and implement tools and resources that enhance our Nation's innovation capacity,
- Gather, analyze, evaluate and utilize the data and insight resulting from the experiences of the I-Corps Teams/Sites, and
- Share and leverage effective innovation practices on a national scale to improve the quality of life for the U.S. citizenry.

I-Corps Regional Nodes contribute to the National Innovation Network in the following three ways:

Level 1 Contribution: *I-Corps Regional Training:* Nodes demonstrate the capacity to deliver an innovation-enhancing training program based on the hypothesis/validation "Customer Development" curriculum that is used to support NSF I-Corps teams. NSF may call upon I-Corps Regional Nodes up to twice a year to host a cohort of approximately 20-25 I-Corps teams in the delivery of the NSF-selected I-Corps curriculum.

Level 2 Contribution: *I-Corps Node Regional Infrastructure:* I-Corps Regional Nodes are developing near-term tools and resources that are intended to impact and expand the benefits of the entire I-Corps program within a 2-3 year timeframe. Level 2 efforts are also addressing the issues associated with accelerating the diffusion/adaption/adoption of effective innovation practices in the national ecosystem, while further building entrepreneurial capacity in the node environments.

Level 3 Contribution: I-Corps Node Blue Sky Research: I-Corps Regional Nodes are leveraging and analyzing data from Level 1 and Level 2 contributions. Key activities are focusing on: 1) developing an understanding of how institutions can improve support for innovation ecosystems; 2) sharing and developing methods for successfully scaling effective practices and models that foster innovation; 3) exploring how the National Innovation Network can enable new collaborations among geographic regions to support commercialization - independent of geographic locations; 4) examining and tracking the I-Corps teams' dynamics, activities and outcomes; and 5) identifying and proposing improvements to the I-Corps curriculum materials, training practices, and National Innovation Network utilization.

NSF established the **I-Corps Sites** program to contribute to the nation's innovation ecosystem. The goals of the Sites program are to spur translation of research, to encourage collaboration between academia and industry, to develop formal, active, local innovation ecosystems that contribute to a larger, national network of mentors, researchers, entrepreneurs and investors, and to train students to understand innovation and entrepreneurship. Through I-Corps Sites, NSF investments strategically strengthen the innovation ecosystem by addressing the challenges inherent in the early stages of the innovation process – the program supports activities that are designed to overcome many of the obstacles in the path of innovation. I-Corps Sites are housed in academic units whose mission is to provide resources to individuals and teams in the form of space, seed funding, entrepreneurial mentoring, curriculum, or other assets needed to transition technology into the marketplace.

As part of an evolving national innovation network, I-Corps Sites are funded at universities to nurture and support multiple, local teams by providing infrastructure, advice, resources, networking opportunities, training and modest funding (\$1,000 to \$3,000 per team over a 3-6 month period) to enable researchers to transition their ideas, devices, processes or other intellectual activities into the marketplace or into becoming I-Corps Team or SBIR applicants. While different institutions may choose different mechanisms for achieving the goals of their I-Corps Site, certain characteristics of a Site must be consistent – projects must be team-centric, the origin and nature of the projects must be STEM-focused, and the kind of support that is provided to the teams by the Site must include assets needed to explore transitioning technology into the marketplace.

The Innovation Corps program is a key element in a series of NSF-supported programs concentrating on the innovation ecosystem. I-Corps has its genesis in a number of long-standing programs within NSF that support the innovation ecosystem, such as Engineering Research Centers (ERC), Industry/University Cooperative Research Centers Program (I/UCRC), Partnerships for Innovation (PFI), Science and Technology Centers (STC), and Materials Research Science and Engineering Centers (MRSEC). In FY 2011 and FY 2012, investments in the inaugural year for I-Corps complemented these long-standing investments. All of these programs are built on the backbone of support for core research, primarily to individual investigators, found in every directorate at NSF.

Cybersecurity

I often hear from technology leaders in Silicon Valley that the government and this country must get more serious on cyber security. The number of attacks is increasing dramatically and as our lives, personal data and the Nation's critical infrastructure become more connected online, we put ourselves ever more at risk to large scale destructive breaches and attacks. A key step to addressing these cyber threats is bringing academics, government agencies, internet/telecommunication companies, and

cyber security companies together in a safe haven environment to share experience and strategies to more effectively combat this growing problem. I have introduced legislation (the Excellence in Cybersecurity Act) that would create centers of excellence around the country to bring together industry leaders with government agencies to identify and analyze existing and future cyber security challenges faced by various industries, to create solutions and promote best practices to address such challenges, and to collaborate with individuals in those industries to share knowledge.

Question 2. How is the NSF's Secure and Trustworthy Cyberspace (SaTC) program addressing the issue of cyber security? Will the SaTC program partner with cyber security industry leaders and try to find industry specific solutions by sharing experience and knowledge?

Answer:

How is the NSF's Secure and Trustworthy Cyberspace (SaTC) program addressing the issue of cyber security?

The NSF's Secure and Trustworthy Cyberspace (SaTC) is an NSF-wide investment that is building the knowledge base in cybersecurity by enabling discovery, learning and innovation, and that will lead to a more secure and trustworthy cyberspace. Through a focus on long-term, foundational research, SaTC is developing the scientific foundations for cybersecurity research that will be useful for years to come. It is also broadening the cybersecurity research portfolio to include more cross-disciplinary projects and to increase opportunities for implementing new technologies that emerge from the research. It is expanding the number of large, multi-institutional projects that provide high-level visibility to cybersecurity grand challenges; and it is establishing curricula recommendations for new courses, degree programs, and educational pathways to develop future cybersecurity experts. SaTC is building a cybersecure society and providing a strong competitive advantage for the Nation's ability to produce high-quality digital systems and a well-trained workforce.

In 2011, the National Science and Technology Council (NSTC), with the cooperation and involvement of NSF, put forward a strategic plan titled *Trustworthy Cyberspace: Strategic Plan for the Federal Cybersecurity Research and Development Program*. This plan identifies a broad, coordinated research agenda to make cyberspace secure and trustworthy. The strategic plan details four goals that together cover a set of interrelated priorities for the federal agencies that conduct or sponsor research and development in cybersecurity. These four goals are: (1) inducing change, (2) developing scientific foundations, (3) maximizing research impact, and (4) accelerating transition to practice. SaTC is meeting these goals through investments in the following areas:

- Inducing change in the current state of cybersecurity by funding research that encourages an adversarial perspective (i.e., thinking like an attacker, with the same goals and methods as an adversary) and that closely examines the security, reliability, resiliency, privacy, usability, and overall trustworthiness of digital infrastructure. Areas of research include tailored trustworthy spaces, moving target, and economic and social incentives.
- Developing scientific and mathematical foundations for cybersecurity research to derive first principles and the fundamental building blocks of security and trustworthiness.
- Maximizing research impact by catalyzing integration across academic disciplines, increasing cooperation between government and the private sector, increasing collaboration across international borders, and protecting critical infrastructure.

- Accelerating transitions to practice by encouraging and enabling adoption and implementation of new technologies so as to create measurable improvements in the cybersecurity landscape.
- Addressing the pivotal issues in the education and preparation of tomorrow's cybersecurity researchers and professionals across all areas of science and engineering.

Will the SaTC program partner with cyber security industry leaders and try to find industry specific solutions by sharing experience and knowledge?

SaTC has, and continues to develop, partnerships with other agencies and industry to effectively achieve its long-term goals. The ongoing partnerships with industry for sharing expertise and knowledge that will lead to industry solutions are described in more detail in the following paragraphs.

The yearly SaTC solicitation has a Transition to Practice (TTP) Option that supports the leveraging of proposed research activities and ideas whose outcomes at the end of the award are capable of being implemented, matured, applied, experimentally deployed, or demonstrated as a useable capability. SaTC provides additional funding for these awards so that research results can be further developed, matured and experimentally deployed in organizations or industries, including in networks and end systems.

The SaTC solicitation established in FY 2012-2014 a project class for "Frontier" awards with budgets of up to \$10 million and durations of up to five years. These are large, multi-disciplinary, multi-organizational, and/or multi-institution projects that provide high-level visibility to grand challenge research areas in cybersecurity. In FY 2012 and 2013, NSF funded five Frontier projects, including projects on cybersecurity for healthcare and wellness, cybersecurity for cloud computing, and cybercrime ecosystems. Some of these projects have collaborations with industry to further the linkages between knowledge and practice. For example, the cloud computing project, which started in FY 2013, plans to hold "Cloud Security Horizons" summits with industry stakeholders to help shape the future of security in cloud computing. The cybercrime ecosystems project is working with Twitter to improve the company's abuse detection infrastructure by integrating into it the project's findings on the underground market for fraudulent accounts.

In FY 2013, the SaTC program held a workshop in partnership with the Computing Community Consortium (CCC) and the Semiconductor Research Corporation (SRC) on fundamental cybersecurity issues of interest to both the semiconductor industry and academic researchers. SRC is a leading technology research consortium, comprising semiconductor companies and university research programs. One of the outcomes from this workshop was a joint partnership between NSF and SRC to support research on Secure, Trustworthy, Assured and Resilient Semiconductors and Systems (STARSS) with a focus on Design for Assurance. More specifically, in FY 2014, the STARSS program plans to fund its first awards on new strategies for computer hardware architecture, specification, and verification, with the aim of decreasing the likelihood of unintended behavior or access, increasing resistance and resilience to tampering, and improving the ability to provide authentication throughout the supply chain and in the field.

In FY 2014, NSF released a Dear Colleague Letter for Innovation Transition (InTrans) awards for project teams completing five-year Frontiers projects in the SaTC program. Research is expected to build on innovations developed within a given Frontier project through close

coordination with industry partner(s). The fundamental research results of the Frontier must drive more applied research with the potential to enable the industrial partner(s) to develop technological innovations with concrete and tangible positive impacts for society. The collaboration must also provide students with opportunities to work closely with industry researchers. To ensure industry commitment to the research grant, these awards will be co-funded by NSF and industry. Further, industry partners will be required to provide the majority of the funding as NSF support for InTrans awards will not exceed one-third of the total co-funding support provided by industry.

In FY 2013, the SaTC program held a first-ever Principal Investigators' (PI) meeting. The meeting brought together over 300 SaTC-funded PIs and co-PIs with interested parties from industry and government agencies and included a focus on results and open questions in the Science of Security. A second SaTC PI meeting is being planned for early- to mid-FY 2015 and will continue to involve industry and government agencies.

In FY 2014, the SaTC program sponsored a 2.5-day workshop centered on identifying high-impact actions that could be taken in any sector to better secure the Internet. The workshop, called the Cybersecurity Ideas Lab, brought together 35 invited experts in computer science, cybersecurity, economics, social science and policy. These experts were drawn from industry, academia, and the government. In addition to advancing the national dialogue on cybersecurity, the workshop yielded a list of concrete recommendations for enhancing the security of the Internet ecosystem that will be published in an upcoming report.

Also in FY 2014 NSF will initiate collaboration with Intel in the area of security for critical infrastructure. Cybersecurity threats exploit the increased complexity and connectivity of critical infrastructure systems, placing the Nation's security, economy, public safety, and health at risk. This partnership combines NSF experience in developing and managing successful large, diverse research portfolios with Intel's long history of building research communities in emerging technology areas through programs such as its Science and Technologies Centers Program.

In FY 2015, the SaTC program is planning to hold a cross-agency workshop that will review the progress made in developing a science of cybersecurity, and that will propose ways that requirements and results can be better communicated across the agencies, as well as among academics and industry.

High-Performance Computing

Question 3. I commend the NSF for its important and historic role in advancing the Nation's competitiveness through support of advanced computing infrastructure and the science and engineering applications it enables. In view of NSF's considerable expertise in high- performance computing for open science, what is NSF's vision for its leadership role in the broader federal context of science-supporting agencies? In particular, how is NSF planning for, and how committed is it to, its vision for maintaining and modernizing its world-class big data and high-performance computing infrastructure, software, and applications that support all areas of scientific research and education, including the most demanding "grand challenge" science problems, accelerating transition to practice?

Answer: Innovation and discovery in science and engineering is increasingly dependent on a cohesive yet dynamic and powerful cyberinfrastructure in which high performance computing (HPC) plays an essential and integral role. The National Science Foundation (NSF) has been

an international leader in high-performance computing deployment, application, research, and education for almost four decades. With the success of HPC modeling and simulation across an increasingly wide range of multidisciplinary research topics and teams, coupled with the advent of next generation instruments and sensors producing vastly larger and more diverse datasets available in real or near-real-time, NSF is committed to position and support the entire spectrum of its research communities, enabling them to be at the cutting edge of advanced computing technologies, hardware and software.

With the *Cyberinfrastructure for 21st Century Science and Engineering Advanced Computing Infrastructure Vision and Strategic Plan*, NSF seeks to promote a complementary, comprehensive, and balanced portfolio of advanced computing infrastructure and programs for research and education. This portfolio supports multidisciplinary computational and data-enabled science and engineering that in turn support the entire scientific, engineering, and education community. NSF is a leader in creating and deploying a comprehensive portfolio of advanced computing infrastructure, programs, and other resources to facilitate cutting-edge foundational research in computational and data-enabled science and engineering (CDS&E) and their application to all disciplines.

The strategies for fulfilling this vision include the following:

- Foundational research to fully exploit parallelism and concurrency through innovations in computational models and languages, mathematics and statistics, algorithms, compilers, operating and run-time systems, middleware, software tools, application frameworks, virtual machines, and advanced hardware.
- Applications research and development in use of high-end computing resources in partnerships with scientific domains, including new computational, mathematical and statistical modeling, simulation, visualization and analytic tools, aggressive domain-centric applications development, and deployment of scalable data management systems.
- Sustainable and innovative resources built, tested, and deployed into a collaborative ecosystem that encompasses integration/coordination with campus and regional systems, networks, cloud services, and/or data centers in partnerships with scientific domains.
- Comprehensive education and workforce programs, ranging in scope from programs designed to develop deep expertise in computational, mathematical and statistical simulation, modeling, and CDS&E to programs designed to enable an advanced technical workforce with career paths in science, academia, government, and industry.
- Transformational and grand challenge community programs that support contemporary complex problem-solving by engaging a comprehensive and integrated approach to science, utilizing high-end computing, data, networking, facilities, software, and multidisciplinary expertise across research communities, other government agencies, and international partnerships.

While support for larger and more complex multiscale, multiphysics simulations are encompassed in these strategies, NSF perceives that an opportunity exists for expanded discovery and economic impact with this comprehensive approach to advanced computing.

In 2013, NSF initiated a two-year National Academy of Science study to examine anticipated priorities and possible decision-making frameworks for NSF in the implementation of its computing strategy in the 2017 – 2020 timeframe. The committee has been recently charged and named. An interim report may be available in late calendar year 2014.

NSF's Assistant Director of the Directorate for Computer and Information Science and Engineering (CISE) is co-chair of the Networking and Information Technology Research and Development (NITRD) Subcommittee of the National Science and Technology Council's Committee on Technology. NSF works in close collaboration with other science-supporting agencies through the NITRD High End Computing (HEC) Interagency Working Group.

**Questions for the Record Submitted by
Adam B. Schiff**

Hispanic-Serving Institutions Program

As you know, the America COMPETES Act of 2007 authorized an NSF program to support Hispanic-Serving Institutions (HSIs). Despite language in the reauthorization of America COMPETES Act of 2010 directing the NSF to maintain support for each of its existing programs for minority-serving institutions -- including HSIs -- an HSI-specific program has not yet been established. In both FY 2013 and 2014, the Committee weighed in on the issue and asked the NSF to report back on plans to establish an HSI-focused program and how existing and planned efforts will meet the specific needs of HSIs through NSF's other programs. Subsequently, the NSF reported on the logistical difficulties of establishing and managing such an initiative and then "proposed a multi-pronged approach... to meet the needs of HSIs by building on prior efforts and focusing on efforts to build capacity, especially in community colleges... including opportunities to increase the participation, retention, and graduation of Hispanics in STEM". While programs dedicated to Historically-Black Colleges and Universities (HBCUs) and Tribal-Serving Institutions (TSIs) have been in place at the NSF for over a decade, Hispanic-Serving Institutions (HSIs) remain one of the most crucial cohorts of minority-serving institutions yet to receive targeted NSF infrastructure development funding in the areas of science, technology, engineering, and math. Recognizing that NSF funding to HBCUs and TSIs have proven essential to the demonstrated success of strengthening STEM initiatives at these institutions and assisting in preparing a strong STEM workforce in a time of utmost need, it would be remiss for us not to continue encouraging and working with the NSF to assist HSIs as well.

Question 1. Can you elaborate on the logistical difficulties of establishing and managing a dedicated HSI program at the NSF, and explain why, in light of the existing program models for other minority-serving institutions that the NSF has managed for over ten years, these difficulties could or could not be overcome?

Answer: In FY 2013, NSF funds awarded to Hispanic-Serving Institutions (HSIs) totaled \$155.65 million through 332 awards. NSF support to HSIs continues to be strong and exceeds the combined total of \$104.52 million for Historically Black Colleges and Universities (HBCUs) and Tribal Colleges and Universities (TCUs). While there are about 105 HBCUs and 30-35 TCUs, in 2010-2013 there were 370 HSIs (defined as institutions with 25 percent or more total undergraduate Hispanic full-time equivalent student enrollment), with an additional 277 "emerging HSIs" (defined as institutions with 15-24 percent undergraduate full-time equivalent Hispanic enrollment). These 370 institutions of higher education are very heterogeneous, including small community colleges, four-year primarily undergraduate institutions, and large research-intensive universities, all with different missions. The range of available STEM programs within these diverse institutions is quite wide. Crafting a single program, comparable to NSF's dedicated programs for HBCUs and TCUs, which has the potential for national scale and serves such a variety of institutions presents a logistical, programmatic, and financial challenge, particularly as the numbers of HSIs are increasing rapidly.

Question 2. Can you update the Committee on the progress of the NSF's proposed initiatives to meet the needs of HSIs that the Foundation committed to undertaking in its

August 2013 report to the Committee? In particular, how has the NSF proceeded to assist STEM initiatives in community colleges?

Answer: In the August 2013 response to Congress, NSF indicated a desire to implement a comprehensive approach to address the needs of HSIs including Dear Colleague Letters (DCLs) that focus on undergraduate education and/or express a commitment to broadening participation of underrepresented groups, engaging HSI community colleges, and creating opportunities for capacity building in HSIs. NSF has developed two DCLs to complement the letter (NSF 12-081) issued in FY 2012, which is still active.⁶

One of the new DCLs encourages HSIs, especially community colleges, to build research capacity through special grant opportunities including Early Concept Grants for Exploratory Research (EAGER) and Conferences, Symposia, and Workshops that focus on evidence-based practices that have been shown to be particularly effective for students at HSIs, as well as exploratory research that may lead to new models and best practices.⁷ Examples of appropriate topics include:

- Understanding factors that will lead to improved retention of students in STEM programs at two-year HSIs.
- Understanding barriers and challenges that prevent the transfer of students at two-year HSIs to four-year colleges; understanding factors that promote the transfer of students including articulation agreements.
- Improving the quality of STEM undergraduate academic and research experiences at two-year HSIs.
- Research on strategies that enhance interest and motivation of students and improve persistence and graduation rates in undergraduate STEM programs at HSIs through innovations in STEM curricula, instructional materials, and research experiences.
- Building capacity at HSIs through collaborations with majority institutions that support faculty research, professional development, and mentoring.

The second DCL encourages current awardees, including HSIs, to apply for supplemental funding to active awards for the purpose of increasing the matriculation of graduates of two-year HSIs to four-year institutions while strengthening strategies for retention in STEM majors, such as providing research experiences for first and second-year undergraduates.⁸

These activities complement ongoing programmatic efforts, which resulted in 46 awards to HSIs in 2013 through several EHR programs including Advanced Technological Education, Louis Stokes Alliances for Minority Participation, and the Robert Noyce Scholarship Program.

Question 3. Has the NSF considered the possibility of creating, or at the very least beginning outlining a plan to create, an HSI-focused program in FY 2015 and to what extent has this been discussed?

Answer: NSF is developing plans to invest in approaches to improve STEM learning for all students, at all levels, including the rapidly growing number of Hispanic students in K-12 settings. NSF continues to explore strategies to increase funding for innovative approaches to improving STEM education at HSIs, especially two-year institutions. More than half of HSIs are two-year institutions. More than half of all undergraduates attend two-year institutions; however,

⁶ www.nsf.gov/pubs/2012/nsf12081/nsf12081.jsp

⁷ www.nsf.gov/pubs/2014/nsf14064/nsf14064.jsp

⁸ www.nsf.gov/pubs/2014/nsf14065/nsf14065.jsp

relatively few Hispanic students who begin college at two-year institutions continue on to earn baccalaureate degrees, particularly in STEM. NSF is aiming to identify the factors that will facilitate the transfer of students from two-year to four-year institutions prepared to enter STEM majors. For FY 2015, discussions are underway to build on the Dear Colleague Letters issued in FY 2014 and to identify options for tracks within existing programs targeting HSI community colleges and critical junctures (high school to college, two-year to four-year institutions). These activities provide the foundation for future efforts designed to build capacity and improve undergraduate education at these institutions. Evaluation of the effectiveness of the DCLs and expanded program tracks will inform future efforts and directions regarding HSIs.

THURSDAY, FEBRUARY 27, 2014.

FEDERAL INVESTMENTS IN NEUROSCIENCE RESEARCH

WITNESSES

Dr. JOHN P. HOLDREN, DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY

Dr. JOHN C. WINGFIELD, ASSISTANT DIRECTOR, DIRECTORATE OF BIOLOGICAL SCIENCES, NATIONAL SCIENCE FOUNDATION

Dr. ALAN I. LESHNER, CHIEF EXECUTIVE OFFICER, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

OPENING REMARKS OF THE CHAIRMAN AND RANKING MEMBER

Mr. WOLF. Good morning. The hearing will come to order. I want to welcome everybody to this hearing on the Federal investments in neuroscience research.

Our witnesses will be Dr. John Holdren, Director of the Office of Science and Technology Policy; Dr. John Wingfield, the Assistant Director of Biological Sciences at the National Science Foundation; and Dr. Alan Leshner, Chief Executive Officer, the American Association for the Advancement of Sciences.

We want to thank you for being here.

In the interest of time, I am going to just make one comment and turn it over to Mr. Fattah. This is really Mr. Fattah's hearing—I mean, I agree with him on all this. But he has been the driver on this. And every time we go to conference, he has always pushed this. So I think I am going to kind of defer to him on most of the hearing.

But it is important. You know, Alzheimer's, ADHD, we all worry about these things. So I just want to pay tribute to Mr. Fattah. This is really Mr. Fattah's issue, if you will. So I appreciate you coming.

With that, I recognize the ranking member.

Mr. FATTAH. I want to thank the chairman. Obviously, this is the chairman's committee. So he has given me full support for this. But we really have had from day one what we call in the business a four-corner agreement among the House and Senate appropriators for CJS that we would make neuroscience a priority. And the chairman has been very supportive of that, along with our colleagues and counterparts in the Senate. So we are very happy that in each of the bills that we have championed through that we have been able to build on the language that asked OSTP to proceed in a way that would look at this in a comprehensive, kind of cross-agency approach and then to build out on that.

We have some great witnesses today, and I want to say a couple things. One is I want to thank all of my congressional colleagues. This really is a bipartisan initiative, and support from the appropriators on this point. I think it is useful for you to understand

that we are very committed to trying to move forward. There are well over 50 million Americans who are challenged by neurologically based diseases, disorders of various kinds. We have a whole set of challenges with returning soldiers. Well over 40 percent who have been injured have a traumatic brain injury or post-traumatic stress and other issues.

This is a strategic issue in terms of our international interactions. The EU has now launched a major multiyear effort, Horizon 2020, which focuses in part on neuroscience. They have the \$1.5 billion investment of the Human Brain Project in Europe. The G8, under David Cameron's leadership, and I know, Dr. Holdren, you have been involved, decided that dementia, as the chairman mentioned, Alzheimer's being the kind of brand name of dementia, but there are a number of them, Parkinson's, Huntington's disease, and asked for all the G8 countries to double their investment.

But the first thing is that what we have done in the original language was to ask OSTP to bring together all of the agencies, and you have done that, and to try to figure out where we can make nonincremental, disruptive progress in this field. And you have a report from an agency working group, and we look forward to your testimony. We also asked through language that the National Science Foundation create a budget theme around neuroscience.

So we want to hear the testimony. And we are looking for ways where we can move forward. The President's embrace of the brain mapping built in the technologies of what we call the BRAIN Initiative is very, very important. I visited Israel, where there has been some focus now on focusing in on a number of these initiatives in cooperation with the United States.

So there are a lot of possibilities here for us to advance humankind. One of the things that the chairman has done throughout his career has been focused on the plight of people everywhere in the world. One of the challenges to human freedom is health and well-being. And so this last remaining mystery of science, how our brains actually work, is critically important.

I want to welcome you.

I think we will have all the testimony, Mr. Chairman, and then we can ask questions.

Mr. WOLF. Thank you, Mr. Fattah.

Mr. WOLF. Before we begin with witness testimony, we want to inform the subcommittee that we are going to administer an oath to all Federal officials who appear before the subcommittee as witnesses, as we did last year and is sanctioned by existing law and the House rules. I do not do this because I feel that any witness will intentionally mislead; instead, I believe it reinforces the seriousness of the committee's work. The agencies and their officials are and should be accountable to the Committee, but more importantly to the American people, so whatever we hear is valid and authentic.

So, 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 Federal witnesses will be sworn in. Dr. Leshner, since you are not a Federal witness, you may remain seated.

[Witnesses sworn.]

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

Your written statements will be made part of the record. You may proceed. Thank you very much.

TESTIMONY OF DR. HOLDREN

Dr. HOLDREN. Well, thank you, Chairman Wolf, Ranking Member Fattah. It is a pleasure to be here to talk about the Federal research enterprise in neuroscience and related areas. I hardly need to tell the two of you that few fields are as complex as neuroscience, the study of the brain's hundred billion neurons and their interactions with the rest of the body.

At the same time, there are few fields that have the potential of neuroscience to provide the kinds of biomedical insights that can really contribute, as you commented, Ranking Member Fattah, in your opening remarks, to reduce the burden of human suffering and disease.

Again, I don't really need to tell you that neurological disorders and stroke affect millions of Americans every year, and cost hundreds of billions of dollars to treat. And despite major advances in recent years, understanding the brain and its relationship to behavior, a field with implications across domains as diverse as education and criminal justice, really remains one of the most important scientific challenges of our time.

With the encouragement of Congress, and particularly with leadership from this committee, my office chartered the Interagency Working Group on Neuroscience in June 2012 under the National Science and Technology Council and its Committee on Science to, quote, "coordinate activities in neuroscience research across the Federal Government with a focus on the fundamental understanding of learning, brain development and plasticity, and brain health and recovery," close quote.

Beginning in the fall of 2012, that working group examined the landscape of Federal research activities and investments related to neuroscience. Its analyses and deliberations have led, as you noted, Congressman Fattah, to a set of recommendations for accelerating progress in neuroscience, including, through enhanced interagency coordination. That group's report was released earlier this week, and a copy was provided to your staff.

One recommendation that came from that analysis is to improve communication and public engagement on the topic of neuroscience. A recent example of outreach of that sort is "Super Neuroscience Saturday," an event cosponsored by OSTP in coordination with other stakeholders last November. Super Neuroscience Saturday included a full day of interactive educational activities for more than 70 students from the Washington, D.C., area about the promise and potential of neuroscience, and it included an evening of public lectures and discussion for adult community members led by neuroscience experts.

In April of 2013, President Obama announced the Brain Research through Advancing Innovative Neurotechnologies Initiative, The BRAIN Initiative, which we characterize as a grand challenge to revolutionize our understanding of the human brain and as a result, generate new ways to treat, cure, and even prevent brain dis-

orders, such as Alzheimer's disease, epilepsy, and traumatic brain injury.

OSTP coordinated the development of that effort with philanthropic and research stakeholders and Federal agencies, including the Defense Advanced Research Projects Agency, the Food and Drug Administration, the National Institutes of Health, and the National Science Foundation.

Besides The BRAIN Initiative, there have long been a variety of other Federal activities in the neuroscience domain. For example, the National Alzheimer's Project aims to coordinate Alzheimer's disease research and services across all Federal agencies as we seek to improve treatment and find a cure for that disease.

To improve prevention, diagnosis, and treatment of mental health conditions affecting veterans, service members, and military families, the President also issued an Executive Order in 2012 that, in part, directed Federal agencies to develop a coordinated national research action plan to improve scientific understanding and treatment of post-traumatic stress disorder, traumatic brain injury, and related conditions.

Finally, I should note that a number of scientific tools to explore the neuroscience frontier, including new neurosensing and neuroimaging technologies, are just now coming to maturity, and that is clearly enhancing the potential for important breakthroughs.

So let me just thank the members of the Committee, particularly the chairman and ranking member, for your initiative and your drive behind these efforts. We really appreciate your support in helping us push the boundaries in this very exciting field. And after the other testimonies, I will be happy to try to answer any questions you may have.

Mr. WOLF. Thank you.

[The information follows:]

Statement of Dr. John P. Holdren
Director, Office of Science and Technology Policy
Executive Office of the President of the United States
to the
Subcommittee on Commerce, Justice, Science, and Related Agencies
of the
Committee on Appropriations
United States House of Representatives
on
February 27, 2014

Chairman Wolf, Ranking Member Fattah, and Members of the Committee, I am pleased to be here with you today to discuss the current state of Federal support for neuroscience and related research and our shared interest in improving the efficiency and effectiveness of Federal programs in this domain.

BACKGROUND

Neuroscience is the study of the brain and nervous system, which control every aspect of body and mind, including heart rate, memory, attention, and muscle movement, as well as pain sensation, decision-making, and sleep-wake cycles. Neuroscience research is essential to understand how people learn, move, speak, interact with the world through senses, and feel emotions. Understanding these complex functions requires detailed information about how the brain's 100 billion nerve cells are created, how they grow and connect through all stages of life, and how they interpret input from the external environment through nerve networks extending throughout the body.

The importance of neuroscience research cannot be overstated. Neurological disorders and stroke affect millions of Americans and cost hundreds of billions of dollars to treat. Today, 50-70 million Americans suffer from sleep-related neurological disorders alone. Advances in neuroscience research enable scientists and medical professionals to both improve fundamental understanding of how the brain and nervous system function and apply that knowledge to better explain, prevent, and treat diseases and disorders of the nervous system. Despite major advances in recent years, understanding the brain and its relationship to behavior remains one of the most important scientific challenges of our time. A broad and comprehensive approach to basic and applied neuroscience research is a critical foundation for advancing efforts to promote and protect brain health; optimize learning strategies and educational paradigms; and develop treatments for the devastating injuries, diseases, and disorders that afflict all age groups and most segments of our society.

The Obama Administration has placed a strong emphasis on ongoing and new neuroscience and related research efforts under the auspices of the White House Neuroscience Initiative. This Initiative encompasses neuroscience and mental health related activities directed by the White House or supported by the White House Office of Science and Technology Policy (OSTP) and seeks opportunities to build upon and coordinate across established efforts within Federal agencies. By identifying strategic opportunities to work across agencies and promote collaboration between the Federal Government and the private sector, the White House Neuroscience Initiative aims to increase the positive impact of Federal investments in neuroscience to improve health, learning, and other outcomes of national importance. The White House Neuroscience Initiative includes or supports such activities as the Interagency Working Group on Neuroscience, The Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative, The National Alzheimer's Project, and other programs described in the following sections.

INTERAGENCY WORKING GROUP ON NEUROSCIENCE

With the encouragement of Congress, including members of this Committee, the Interagency Working Group on Neuroscience (IWGN) was chartered by OSTP in June 2012 under the National Science and Technology Council's (NSTC) Committee on Science to "*coordinate activities in neuroscience research across the Federal government with a focus on the fundamental understanding of learning, brain development and plasticity, and brain health and recovery.*" Co-chaired by OSTP, the National Science Foundation, and the National Institutes of Health, the IWGN membership comprises more than twenty Federal departments and agencies with equities in neuroscience research and diverse missions that include funding, conducting, and utilizing research related to health, education, public safety, security, intelligence, defense, and more. The IWGN's mission is to enhance Federal efforts related to improving understanding of learning and cognition; elucidating the causes and impacts of neurological disorders and injuries; and developing appropriate resources, tools, interventions, and therapies to assist in research, treatment, and recovery.

Ongoing IWGN efforts, coordinated by OSTP, involve encouraging and supporting scientific research; sponsoring workshops to set forward-looking research agendas; developing and establishing common standards and guidelines; and sharing data and information. Beginning in fall 2012, the IWGN examined the landscape of basic and applied Federal research activities and investments related to neuroscience. The IWGN's analyses and deliberations have resulted in a set of recommendations for accelerating progress in neuroscience through enhanced interagency coordination. The IWGN recently released a report identifying challenges and proposing recommendations in each of five areas of research, policy, and communication: understanding and applying the brain's information processing capabilities; understanding and treating brain diseases, disorders, and trauma; understanding and optimizing interactions between the environment and the brain across the lifespan; translating research to practice; and improving communication and engaging the public. The report also highlights a subset of recommendations that can be implemented in the near term.

One of the recommendations stemming from this report is to improve communication and engagement with the public on the topic of neuroscience. A recent example of such outreach is "Super Neuroscience Saturday," an event that was co-sponsored by OSTP, the Smithsonian Institution, the American Association for the Advancement of Science (AAAS) Science & Technology Policy Fellowships' Neuropolicy Affinity Group, and the Society for Neuroscience Washington, DC, Metro Area Chapter in November 2013. Super Neuroscience Saturday included a full day of educational activities meant to inspire DC area students about the promise and potential of neuroscience, hosted in partnership with the National Museum of Natural History, as well as an evening of public lectures and discussion with leading experts meant to expand awareness of neuroscience issues, held at AAAS.

THE BRAIN INITIATIVE

On April 2, 2013, President Obama announced The BRAIN Initiative, a Grand Challenge designed to revolutionize our understanding of the human brain. OSTP coordinated the development of this effort with Federal agencies and philanthropic and research stakeholders. Under this initiative, Federal agencies including the Defense Advanced Research Projects Agency (DARPA), the National Institutes of Health (NIH), the National Science Foundation (NSF), and more recently, the Food and Drug Administration (FDA) support the development and application of innovative new technologies that can create a dynamic understanding of brain function and its relationship to behavior. When launching the Initiative, President Obama challenged the participants to give "scientists the tools they need to get a dynamic picture of the brain in action and better understand how we think and how we learn and how we remember." The

BRAIN Initiative ultimately aims to generate new ways to treat, cure, and even prevent brain disorders, such as Alzheimer's disease, epilepsy, and traumatic brain injury.

Recently, DARPA, NIH, and NSF have all announced significant new awards and solicitations related to The BRAIN Initiative. In December, the NIH released new solicitations that will provide \$40 million in research funding to advance the goals of The BRAIN Initiative, including funding to generate an inventory of the different cell types in the brain; develop new tools to analyze the complex circuits responsible for brain function; develop new approaches to record the activity of large numbers of neurons in any location in the brain and improve existing technologies for widespread adoption of these techniques; understand large-scale neural circuits by integrating experimental, analytical, and theoretical approaches; and develop the next generation of non-invasive imaging technologies. The research breakthroughs and technologies developed through these efforts have the potential to profoundly improve the lives of the millions of Americans suffering from neurological disorders.

In addition, DARPA is supporting the development of technologies that will improve the understanding and treatment of neuropsychological illness for American veterans and service members through more precise neural stimulation therapies. The agency has also launched a new program to understand how neural stimulation could enable recovery of memory following brain injury.

NSF has announced its intent to support The BRAIN Initiative across a broad range of scientific disciplines, from psychology through engineering. For example, NSF recently awarded \$25 million to the Center for Brains, Minds and Machines based at the Massachusetts Institute of Technology and Harvard University and partnering with many other institutions around the country. This Center seeks to advance understanding of human intelligence and develop truly intelligent machines through interdisciplinary collaborations between researchers in computer science, math, statistics, robotics, neuroscience, and cognitive science.

Given The BRAIN Initiative's ambitious goals, President Obama has called for The BRAIN Initiative to be an "all hands on deck" effort involving the Federal Government, companies, health systems, patient advocacy organizations, philanthropists, state governments, research universities, private research institutes, and scientific societies. For example, President Obama has highlighted the investments being made by foundations and private research organizations such as the Allen Institute for Brain Science, the Howard Hughes Medical Institute, and the Kavli Foundation.

Later this year, the White House plans to hold an event to highlight public and private commitments that respond to the President's call to action. Examples of the kinds of commitments that advance The BRAIN Initiative include: support for basic and translational research and shared facilities at universities and private research institutes; efforts by patient advocacy organizations to accelerate the development of diagnostics, treatments, and cures; information technology infrastructure that improves researchers' abilities to store, share, visualize, and analyze the huge volumes of data that The BRAIN Initiative will generate; pre-competitive collaborations involving industry, such as the recently announced Accelerating Medicines Partnership between NIH, 10 leading pharmaceutical companies, and several non-profit disease foundations; education and training programs to prepare the next generation of scientists, engineers and entrepreneurs; regional "clusters" to accelerate economic growth, job creation, and innovation in neurotechnology-related industries; and well-designed incentive prizes.

OTHER FEDERAL ACTIVITIES

National Alzheimer's Project. An increasing number of our Nation's elders and their families are faced with the burden and tragedy of disorders such as Alzheimer's disease, resulting in profound societal and economic impacts. A 2010 Alzheimer's Association report projected that delaying the onset of

Alzheimer's disease by just five years could save \$50 billion in annual U.S. health care costs. In order to confront these challenges, on January 4, 2011, President Obama signed into law the National Alzheimer's Project Act, requiring the Secretary of the U.S. Department of Health and Human Services to establish the National Alzheimer's Project. This Project will create and maintain an integrated national plan to overcome Alzheimer's disease; coordinate Alzheimer's disease research and services across all Federal agencies; accelerate the development of treatments that would prevent, halt, or reverse the course of Alzheimer's disease; improve early diagnosis and coordination of care and treatment of Alzheimer's disease; improve outcomes for ethnic and racial minority populations that are at higher risk for Alzheimer's disease; and coordinate with international bodies to fight Alzheimer's and other neurodegenerative diseases globally.

Improving Mental Health Prevention and Treatment Services. The President's FY 2014 budget request included approximately \$2.3 billion in mental health research funded by several NIH Institutes and Centers. The Administration is pleased that Congress endorsed the direction this budget proposed to fund research that aims to transform the understanding and treatment of mental illnesses through basic and clinical research, paving the way for prevention, recovery, and cure. For example, the budget proposed to support The BRAIN Initiative's efforts to develop technology to explore how the brain processes information and explore the complex linkages between brain function and behavior. This knowledge could lead to the creation of new tools and techniques for treating conditions such as depression and schizophrenia.

Executive Order on Access to Mental Health Services. To improve prevention, diagnosis, and treatment of mental health conditions affecting veterans, service members, and military families, the President issued an Executive Order in 2012 which, in part, directed Federal agencies to develop a coordinated National Research Action Plan. The Departments of Defense, Veterans Affairs, Health and Human Services, and Education have responded to the President's call with a wide-reaching plan to improve scientific understanding; provide effective treatment; and reduce occurrences of Post-Traumatic Stress Disorder (PTSD), Traumatic Brain Injury (TBI), various co-occurring conditions, and suicide. The plan builds on substantial work already underway in Federal agencies and provides a framework for improved coordination both across government and with scientists from the academic and private sectors to share information, brainstorm innovations, and accelerate productive scientific outcomes, in particular to enhance the detection, prevention, and treatment of PTSD, suicide, and TBI.

INTERNATIONAL COLLABORATION

OSTP and the IWGN have worked to identify concrete opportunities to leverage and accelerate the impact of Federal investments in neuroscience to improve health, learning, and other outcomes of national importance. Some of these opportunities have also been recognized by international partners, resulting in both collaborative and complementary efforts to advance neuroscience research.

For example, in 2013, the European Commission launched the Human Brain Project to use advanced supercomputers to simulate the human brain in order to better understand how it functions. Leveraging the Commission's investment in this activity with complementary efforts through The BRAIN Initiative to understand brain function will significantly advance the frontiers of neuroscience.

In December, 2013, the United Kingdom hosted the G8 nations for a Dementia Summit to build the foundation for an international effort to approach the problem of dementia. OSTP represented the White House at this summit, which set ambitious goals for identifying the causes of and pursuing therapies for dementia through shared research plans and encouraging open access to dementia-related research data and results. In the coming years, the United States and France will both host events building on this meeting's outcomes, including a summit to be hosted by NIH in February 2015.

The Binational Industrial Research and Development Foundation (BIRD), a U.S.-Israeli foundation to stimulate cooperation between the U.S. and Israeli private-sector high-tech industries, has recently expressed interest in pursuing collaborative activities in neuroscience. This long-standing, successful foundation co-sponsored a 2012 Neurotechnology and Neuroscience Conference with the U.S.-Israel Science and Technology Foundation and the U.S.-Israel Binational Science Foundation to bring together American and Israeli experts in neuroscience to discuss recent advances in the understanding of brain function and brain disorders. In addition, through the Collaborative Research in Computational Neuroscience (CRCNS) program, NSF, NIH, the German Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung), the French National Research Agency (Agence Nationale de la Recherche), and the United States-Israel Binational Science Foundation support collaborative activities that will advance the understanding of nervous system structure and function, mechanisms underlying nervous system disorders, and computational strategies used by the nervous system.

Finally, the European Union Joint Programme – Neurodegenerative Disease Research (JPND) is the largest global research initiative aimed at tackling the challenge of neurodegenerative diseases. The NSTC Interagency Working Group on Neuroscience will coordinate discussions with the JPND on common research goals that would benefit from joint action among countries.

CONCLUSION

In summary, this Administration and OSTP are actively working to coordinate a wide range of Federal activities related to neuroscience research. The potential of these endeavors to help advance our fundamental understanding of the human brain and behavior, and to improve the prevention, treatment, and cure of neurological and related diseases cannot be overstated; the human and economic costs of these challenges are substantial and continue to grow. I thank the Committee for its continued support and interest in this issue and I look forward to continuing to work with you. I will be pleased to take any questions that the Members may have.

Mr. WOLF. Dr. Wingfield.

TESTIMONY OF DR. WINGFIELD

Mr. WINGFIELD. Yes. Good morning, Chairman Wolf, Ranking Member Fattah, and members of the Subcommittee. My name is John Wingfield, and I for the past 3 years have had the honor of serving as Assistant Director for the Biological Sciences at the National Science Foundation. It is my privilege to be here today with you and with Dr. Holdren and Dr. Leshner to talk about the National Science Foundation's role in The BRAIN Initiative.

Understanding the brain is one of humanity's greatest scientific challenges and achieving this understanding will have clear and great societal benefits. This imperative has been recognized by the National Academies and has moved forward with congressional guidance and the President's announcement of The BRAIN Initiative.

Mr. Chairman, the NSF is well prepared to accelerate research to understand the brain. For over 30 years, investments by NSF core programs have catalyzed discoveries in brain structure, development, function, cognition, and behavior. NSF support for key research and data infrastructure has led to technical breakthroughs, such as optogenetics and other advanced experimental and imaging techniques that are revolutionizing the study of living brains across many organisms.

High-risk, high-reward innovations, including brain-machine interfaces designed to restore lost function in human injury or disease, the first FDA-approved artificial retina, and the new CLARITY technique for visualizing neuropathways in preserved brains, all of these were developed with NSF support.

In fiscal year 2012, this Committee encouraged the NSF to expand cross-cutting investments in cognitive science and neuroscience. Our fiscal year 2014 budget includes new investments of nearly \$14 million in these areas with an additional \$20 million devoted to The BRAIN Initiative. Following the President's announcement, NSF engaged leaders across the relevant scientific and engineering disciplines in a series of workshops to identify key gaps in scientific understanding and guide NSF's investment strategy.

We have gained much knowledge of individual genetic, molecular, and cellular elements of the brain and nervous system. However, the frontier lies in understanding how these elements interact to produce the stable, functioning whole, and how cognition and action emerge in response to information in the environment. Addressing this frontier requires key investments in areas where NSF is uniquely strong.

First, NSF is increasing its already strong emphasis on *integrative and interdisciplinary* fundamental research across the scientific and engineering disciplines. Second, NSF is investing in the development of new *theories, computational models, and analytical tools* to guide research questions and synthesize experimental data. Third, NSF is increasing emphasis on the development of *innovative technologies and data infrastructure*. These technologies will enable the experimental recording and neurocontrol capabilities required for recovery of lost function. And new data infrastructure is

required to handle the expected large-scale and diverse data sets resulting from this research.

Mr. Chairman, collaborative expertise in science, engineering, and education is already addressing these priority areas. Research Coordination Network awards have established novel neuroscience collaborations. A new \$25 million Science and Technology Center has been funded on "Brains, Minds, and Machines". And \$5 million in new interdisciplinary awards are focused on understanding the brain. These are the first of many new investments to come.

Lastly, NSF is moving forward with the BRAIN Initiative in coordination with other agencies. NSF participates *ex officio* in the National Institutes of Health's efforts to define its own plans for The BRAIN Initiative, and consults regularly with the White House and participating agencies to ensure that our plans and activities are coordinated and distinct.

In summary, first and foremost, NSF is focused on support for basic research and education in science and engineering. Our investments in neuroscience, cognitive science, and The BRAIN Initiative build upon this focus to develop the neurotechnologies and concepts that will ultimately form the basis for future translational results. As always, NSF seeks to accelerate scientific discovery, promote advances in technology, educate and train a competitive scientific workforce, and thereby enhance the lives of Americans through fundamental research.

Thank you, Chairman Wolf, Ranking Member Fattah, and members of the Subcommittee for this opportunity to highlight NSF's contributions to the Nation's quest to understand the brain. I will be pleased to answer any questions you may have.

Mr. FATTAH. Thank you.

[The information follows:]



Testimony of

Dr. John C. Wingfield

Assistant Director
Biological Sciences
National Science Foundation

Before the

Committee on Appropriations
Subcommittee on Commerce, Justice, Science and Related Agencies
United States House of Representatives

on

“Understanding the Brain – In Context, In Action”
NSF’s Role in the BRAIN Initiative

February 27, 2014

Chairman Wolf, Ranking Member Fattah, and Members of the Subcommittee, it is my privilege to be here today with you and with Dr. Holdren to discuss the National Science Foundation’s role in The BRAIN Initiative.

Introduction

Understanding the brain is one of humanity’s greatest scientific challenges and achieving this understanding will clearly have great societal benefits. This imperative has been recognized by advisory bodies including the National Academies,¹ and has moved forward with the guidance of Congress and by the President’s announcement of The BRAIN Initiative.

With its broad support for science, engineering and STEM education, NSF is well positioned to advance research on understanding the brain – by bringing together a wide-range of scientific

¹ A National Research Council report entitled, “*Research at the Intersection of the Physical and Life Sciences*” (2010) identified “Understanding the Brain” as one of five foremost grand challenges, at the interface of the life and physical sciences. The National Academy of Engineering has also recognized “*Reverse-Engineering the Brain*” as a Grand Challenge for Engineering (2008).

and engineering disciplines to reveal the basic physical (e.g. biophysical, biochemical), neuronal, networking, and computational principles underlying brain organization and reorganization that govern learning, cognition, and behavior.

For over thirty years, the scientific investments of NSF core programs has catalyzed transformative breakthroughs in brain research and related enabling technologies. Fundamental discoveries that began with NSF support led to the development of the optogenetics technique for experimentally manipulating brain neurons in living organisms, the CLARITY transparent brain preservation and mapping technique, brain-machine interface systems designed to restore lost function from disease or injury, and the first FDA-approved artificial retina. NSF funding for research that compares similar neural circuits and mechanisms in different animals, including humans, is both unique and critical and has led to conceptual breakthroughs in basic principles of brain structure and function.

Furthermore, NSF's capacity for driving integrative research across multiple disciplines – a key to accelerating progress in understanding the brain – is exemplified by the highly successful BioMaPS program, a multi-directorate collaboration focused on supporting research teams at the interfaces of the biological, mathematical, physical and chemical sciences and engineering. Future efforts under BioMaPS will support the development of the neurotechnologies needed for new molecular and cellular neuroscience research. Similarly, the Collaborative Research in Computational Neuroscience (CRCNS) program is a multi-directorate effort to build on the theories and findings of computer science, cognitive science, neuroscience and other related fields to advance understanding of nervous system structure and function. NSF is also a leader in supporting key developments in advanced cyberinfrastructure that enable processing, analysis and storage of large cross-disciplinary data sets like those that will be generated under The BRAIN Initiative. Finally, NSF's importance in enabling coordination of neuroscience research at the global scale is exemplified by NSF's long history of support for the International Neuroinformatics Coordinating Facility.

Recent Investments Relating to Understanding the Brain

In FY 2012, Congress encouraged NSF to establish a “**cognitive science and neuroscience crosscutting theme**” to sustain and expand investments in “the non-medical aspects of cognitive sciences and neurosciences, particularly through interdisciplinary science, computational models, visualization techniques, innovative technologies, and the underlying data and data infrastructure needed to transform our understanding of these areas.” NSF responded in FY 2013 by encouraging the submission of transformative new proposals across disciplines for research aimed at understanding the brain and cognition. In its FY 2014 Budget Request, NSF proposed new investments of nearly \$14 million to catalyze new research at the frontiers of neuroscience, neuroengineering, and cognitive science.

The President announced The BRAIN Initiative on April 2, 2013 and identified NSF, NIH, and DARPA as the lead agencies. NSF's \$20 million support for The BRAIN Initiative in FY 2014 leverages existing investments in research across a wide range of topics and disciplines related to The BRAIN Initiative.

NSF Goals and Plans for The BRAIN Initiative

Following the President's announcement, NSF immediately began engaging leaders across the relevant scientific and engineering disciplines in discussions to identify priority research areas for meeting the goals of The BRAIN Initiative. Over the past year, NSF has supported the following planning and prioritization workshops across many of the disciplines and thematic areas of The BRAIN Initiative:

- *Physical and Mathematical Principles of Brain Structure and Function*, May 2013
Sponsored by the Directorates of Mathematical and Physical Sciences and Biological Sciences, this workshop brought together research leaders to identify key gaps in conceptual, experimental, computational, theoretical and data handling methodologies and tools needed to advance understanding of the brain.
- *Linking Language and Cognition to Neuroscience via Computation*, May 2013
Sponsored by the Directorates of Social, Behavioral, and Economic Sciences and Computer and Information Science and Engineering, this workshop comprised experts across computer science, linguistics, cognition, neuroscience and genetics to identify how principles elucidated and techniques employed in these disciplines could inform collaborations and advance discovery.
- *Integrating Approaches to Computational Cognition*, May 2013
Sponsored by the Directorates of Social, Behavioral, and Economic Sciences and Computer and Information Science and Engineering, this workshop brought key research leaders together to identify the conceptual frameworks, technologies and research tools needed to integrate cognitive science and machine learning disciplines and open new vistas on brain research.
- *Mapping and Engineering the Brain*, August 2013
Sponsored by the Directorate of Engineering, this workshop comprised experts in bioengineering, neuroscience and research infrastructure development, and focused on the needs for improved capabilities and techniques in advanced neuroimaging, multi-scale modelling, and experimentation in naturalistic environments.
- *Phylogenetic Principles of Brain Structure and Function*, October 2013
Sponsored by the Directorate of Biological Sciences and the Howard Hughes Medical Institute/Janelia Farms, experts in fundamental biology at this workshop looked specifically at the need for reference species to accelerate comparative brain mapping research, and the associated cross-disciplinary coordination and workforce training.
- *Quantitative Theories of Learning, Memory, and Prediction*, planned for May 2014
Sponsored by the Directorates of Mathematical and Physical Sciences and Social, Behavioral and Economic Sciences, this workshop will comprise leaders in the fields of computational neuroscience, cognition and behavior to identify needs for conceptual frameworks that guide research into the relationship between brain and behavior.

This broad-based NSF engagement with the scientific community – which has included Nobel laureates, leading domestic and international scientists, as well as members of the NIH Advisory

Committee to the Director on The BRAIN Initiative – has served to identify the technological and conceptual advances in neuroscience, neuroengineering, and cognitive science that are most important for understanding the brain, which in turn guide NSF investments in these areas.

This review by the scientific community has shown that we have gained much knowledge of the individual genetic, molecular, cellular, and biochemical elements of the brain and nervous system. Recent research enabled by new methodologies and tools has also revealed some of the relationships between these elements and simple cognitive processes and behaviors. However, science must move beyond investigating simple linear relationships to discover how complex systems emerge from their individual elements. The causal connection of multi-directional interactions among these elements with normal brain function, cognition and behavior, within a broad environmental context, will continue to engage the efforts of the scientific community for the foreseeable future

To attain a fundamental scientific understanding of the full complexity of the brain, in context and in action, **NSF investments in The BRAIN Initiative are focused on generating an array of physical and conceptual tools** needed to determine how healthy brains function over the lifespan of an organism, including humans; and on deployment and utilization of these tools to produce a comprehensive understanding of how thoughts, memories and actions emerge from the dynamic activities of the brain. NSF is leveraging and expanding its investments in high-risk/high reward exploratory and transformational scientific and engineering research in three areas where it is uniquely strong:

First, NSF is increasing its already strong emphasis on **integrative and interdisciplinary fundamental research** using new collaborations among the science and engineering disciplines to expand and improve our understanding of the brain, and to develop the scientific workforce.

Second, NSF is investing in development of **new theories, computational models and analytical tools** that will guide research questions and synthesize experimental data.

And third, NSF is placing more emphasis on the **development of innovative technologies and data infrastructure** that are required to handle the expected large scale data sets resulting from this research, and enable new experimental recording and neuro-control capabilities required for recovery of normal function.

Expertise in science, engineering and education at NSF is being brought together to accelerate relevant fields of research across these priority investment areas. Examples of such new investments include:

- New NSF-funded Research Coordination Networks (RCNs) to organize the scientific community and increase collaborative efforts in neuroscience
- A new \$25 million Science and Technology Center (STC) on “Brains, Minds, and Machines” at the Massachusetts Institute of Technology.
- \$5 million in interdisciplinary awards to stimulate potentially transformative research, including basic experimentation, theory development, computation, and technology development related to understanding the brain.

- An Engineering Research Center (ERC) at the University of Washington on Sensorimotor Neural Engineering, which is developing engineering models and neural interfaces that correct or compensate for neural deficits and augment neural capabilities.
- Recently established partnerships with other agencies and non-governmental organizations to leverage support for workshops, training, and collaborative opportunities in targeted areas of mutual interest for understanding the brain.

NSF Interagency and International Coordination

NSF's plans for The BRAIN Initiative are informed by its extensive engagement with interagency and international neuroscience activities. In FY 2013, NSF began co-chairing the Interagency Working Group on Neuroscience (IWGN), chartered under the National Science and Technology Council by the Office of Science and Technology Policy to coordinate neuroscience research efforts across the federal government. NSF representation on the IWGN spans all relevant science and engineering directorates. NSF also participates as an *ex-officio* member of the NIH Advisory Committee to the Director on The BRAIN Initiative, and maintains regular high-level contact with NIH, DARPA and OSTP to ensure that agency plans and activities for The BRAIN Initiative are coordinated and distinct. At the scientific level, NSF and NIH have partnered for many years to support computational neuroscience research through the Collaborative Research in Computational Neuroscience Program, which also increasingly includes international participation, currently by France, Germany, and Israel. Finally, as mentioned earlier, NSF has been a sustaining supporter of the International Neuroinformatics Coordinating Facility.

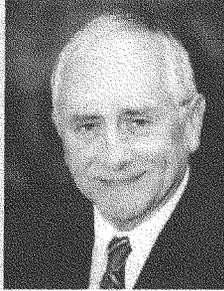
Summary

Mr. Chairman, first and foremost, NSF is focused on support for *basic research and education* in science and engineering. Our investments in neuroscience, cognitive science and The BRAIN Initiative are building upon this focus to provide the foundation for development of neurotechnologies and concepts that ultimately form the basis for future translational results.

The results of our new cross-foundation activities are aimed at accelerating scientific discovery and innovation, promoting advances in technology, and ultimately, improving the competitiveness of the American scientific workforce and enhancing the lives of Americans. Improved understanding of the brain will promote better brain health; enable engineered solutions that enhance, replace or compensate for lost function; improve the effectiveness of formal and informal educational approaches; and lead to brain-inspired smarter technologies for improved quality of life. Basic research in these areas will also offer novel insights into how cognitive abilities develop and can be maintained and improved throughout the lifespan.

Thank you, Mr. Chairman for this opportunity to highlight NSF's contributions to the nation's quest to understand the brain. I will be pleased to answer any questions you may have.

Dr. John C. Wingfield, Assistant Director, Biological Sciences (BIO)



Dr. John C. Wingfield is the assistant director for Biological Sciences (BIO) at the National Science Foundation (NSF). Wingfield's research has covered a wide spectrum of biology from molecular and organismal to environmental and ecological scales. He joined NSF as division director for Integrative Organismal Systems in September 2010 from the University of California, Davis.

Wingfield is a distinguished scientist and active researcher with a strong record of scholarly scientific publication and leadership experience. His research focuses on neural pathways for environmental signals affecting seasonality in birds and their mechanisms of coping with environmental stress. His research also interfaces with how animals deal with global climate change, endocrine disruption and conservation biology.

Wingfield has delivered numerous invited lectures, served on several editorial boards, and held positions as associate editor and/or editor-in-chief for major journals in his fields. He has received many honors from his peers and served as president of the Society for Integrative and Comparative Biology. He also has an extensive record of service to NSF and scientific advisory boards. Prior to joining NSF in 2010, Wingfield was the chair for the department of zoology at the University of Washington from 1999 to 2003, and has held an Endowed Chair in Physiology at UC-Davis since 2007.

Wingfield received his Bachelor of Science degree in zoology from the University of Sheffield and a Ph.D. in zoology and comparative endocrinology from the University College of North Wales.

Credit: NSF/Photo by Sandy Schaeffer

TESTIMONY OF DR. LESHNER

Dr. LESHNER. Thank you, very much, Chairman Wolf, Ranking Member Fattah, members of the Committee. I want to start by thanking you for inviting me to join this distinguished panel to speak about the Federal Government's role in neuroscience research. I am a neuroscientist myself by background, and I believe we are living in unquestionably the most exciting scientific time in my over-40-year scientific career. Not only are we learning a tremendous amount about how the brain is structured and functions, but we are making great progress in understanding and developing treatments for a wide array of brain disorders that, as has been mentioned, have such widespread and devastating effects throughout society.

As has also been mentioned, we also finally have an array of major multisector neuroscience initiatives going on. I have been waiting 30 years for this, and I am really very pleased and hope that we will seize the moment fully. Drs. Holdren and Wingfield have mentioned the U.S. Government's exciting Brain Research through Advancing Innovative Neurotechnologies project. In addition, Mr. Fattah mentioned that the European Commission this year launched an elaborate Human Brain Project, also recognizing the great potential in neuroscience research.

Exploiting these initiatives to yield the scientific, clinical, and economic benefits that we all want will require both political and policymaker support and the endorsement and an extensive involvement of the neuroscience community. Having been in town so long, I have to say that some people may note that we already saw a decade of the brain come and go with relatively little direct result 20 years ago. And a reasonable question is, so what is different now?

Just to remind you, in 1990, U.S. President George H.W. Bush declared the 1990s to be the decade of the brain. And shortly thereafter, the European Decade of Brain Research was announced. But relatively little special funding was ever allocated to them. In the absence of substantial dedicated funding and little scientific coordination, and, frankly, with no real champions of the efforts in the policymaking community, neither the U.S. nor the European brain projects gained momentum or generated unified advocacy among scientists.

While I am delighted to say that circumstances are dramatically different now, and the neuroscience community knows it and is responding enthusiastically, critical, of course, is the fact that neuroscience research has progressed at an explosive rate. Never before has the often quoted adage that we have learned more about the brain in the past decade than in all of recorded history been more appropriate. Some of this progress has resulted from advances in the technologies that allow neuroscientists to ask wholly new kinds of questions. Some has come from the collaboration among multiple fields that characterizes so much of modern science. And an increasing focus on translational research is yielding new treatment approaches in neurology and psychiatry, and greater hope for practitioners and patients.

We are, in fact, on the threshold of being able to answer even the most difficult questions about our brains and minds. Breakthroughs in many neuroscience subdisciplines, particularly when integrated with advances in molecular biology, psychology, neurology, chemistry, mathematics, physics, engineering, and computer science—those are the collaborators—are providing the groundwork for major leaps forward by neuroscience as a whole.

What is needed to realize this potential is to harness technological advances onto this foundation in order to bring this burgeoning set of fields to a new level of understanding. The new neuroscience initiatives are, from my point of view, directed explicitly at the right targets, at these urgently needed technological advances and their applications.

We are also very fortunate to have many neuroscience champions in the policymaking community, which, frankly, we were lacking 20 years ago. As Dr. Holdren has testified, the brain project announced by the President being coordinated by OSTP involves the leaders of many U.S. Science funding agencies as well as some of the most important and influential private philanthropies. Here in the U.S. Congress, there is an active bipartisan Neuroscience Caucus organized by Representatives Rogers and Blumenauer, and it includes, of course, influential Members of Congress, such as the subcommittee's ranking member, Chaka Fattah, who I believe to be one of the most informed and great champions of neuroscience initiatives we have had.

The new interagency brain initiatives have great potential to take advantage of the dramatic advances we have made in the last decade and continue to accelerate progress in all of both basic and clinical neuroscience. Agencies like the National Science Foundation and the National Institutes of Health are both working together and individually exploiting their unique roles to ensure that the Nation realizes the great potential in neuroscience research. Just as an example, NSF's unique ability to bring together researchers from mathematics, the physical and life sciences, and engineering in truly multidisciplinary ways will be a major force in the neuroscience advances of the future.

This is a particularly opportune time, and I urge you to seize the moment. The promise of the Nation's neuroscience initiatives should be embraced as broadly as possible and they should be supported as fully as we possibly can. Thank you very much.

Mr. WOLF. Thank you very much.

[The information follows:]

**Testimony before the
House Commerce, Justice, Science Appropriations Subcommittee
by
Alan I. Leshner, Ph.D.
American Association for the Advancement of Science
February 27, 2014**

Chairman Wolf, Ranking Member Fattah, members of the subcommittee my name is Alan Leshner and I am the Chief Executive Officer of the American Association for the Advancement of Science (AAAS) and Executive Publisher of the prestigious, peer-reviewed journal *Science*. Thank you for inviting me to testify before you today on the federal government's role in neuroscience research. I am a neuroscientist by background myself, and I believe we are living in unquestionably the most exciting time in my over 40 year scientific career. Not only are we learning a tremendous amount about how the brain is structured and functions – including to produce our minds – but we are making great progress in understanding and developing treatments for a wide array of brain disorders that have such widespread and devastating effects throughout society.

I am delighted to note that along with the great advances in neuroscience, we also finally have an array of major multi-sector neuroscience initiatives ongoing. This year, the European Commission launched a Human Brain Project, and the U.S. government announced its Brain Research through Advancing Innovative Neurotechnologies (BRAIN) project. They join other recent neuroscience efforts across the world recognizing the great recent progress in brain research and aimed at advancing our understanding of the brain. Exploiting these diverse initiatives to yield scientific, clinical, and economic benefits, however, will require not only political and policy-maker support but also endorsement and extensive involvement by the neuroscience community, which already saw a “Decade of the Brain” come and go about 20 years ago, with little direct result. A reasonable question is: What's different now?

In 1990, U.S. President George H. W. Bush declared the 1990s to be the Decade of the Brain and shortly thereafter the European Decade of Brain Research was announced. Yet relatively little special funding was ever allocated to them. In the absence of substantial dedicated funding, little scientific coordination, and with no real champions of the efforts in the policy-making community, neither the U.S. nor the European brain project gained momentum or generated unified advocacy among scientists.

Circumstances are dramatically different now. Neuroscience research has progressed at an explosive rate and never before has the often-quoted adage of having learned more about the brain in the past decade than in all of recorded history been more apt. Some of this progress has resulted from advances in the technologies that allow neuroscientists to ask wholly new kinds of questions; some from the collaboration among multiple fields that characterizes so much of

modern science. An increasing focus on translational research is yielding new treatment approaches in neurology and psychiatry and greater hope for practitioners and patients.

In 2008, I chaired an Institute of Medicine report on grand challenges facing neuroscience research entitled “From Molecules to Minds.” We identified three fundamental scientific questions and goals to inspire and challenge the scientific research community. The three grand challenges included:

- How does the brain work and produce mental activity like thought and emotion?
- How does the interplay of biology and experience shape our brains and make us who we are?
- How do we keep our brains healthy? How do we protect, restore, or enhance the functioning of our brains as we age?

We are, in fact, on the threshold of being able to answer these kinds of difficult questions, and to do so, the neuroscience community must fully exploit the opportunities provided by the governmental initiatives, even if it requires some behavior change among scientists.

Breakthroughs in many neuroscience sub-disciplines, such as molecular biology, psychology, neurology, chemistry, mathematics, physics, engineering, and computer science have laid the groundwork for a major leap forward by neuroscience as a whole. What is needed today is to harness technological advances on to this foundation in order to bring this burgeoning set of fields to a new level of understanding. For example, advances in neuroimaging technologies through the 1990’s revolutionized our understanding of how the brain functions, and those advances changed our fundamental conceptions of phenomena like mental illness and substance abuse; the new imaging technologies that will be developed through, for example, the U.S. government’s BRAIN initiative will enable much finer grain analysis needed to understand how the brain is organized and generates phenomena like consciousness.

In many ways, the future of neuroscience research will resemble “big science,” like the Human Genome Project, requiring extensive coordination among many scientists and subfields. On the other hand, in spite of increasing interdisciplinary collaboration, neuroscience still remains more typically a “small science” field, characterized by individual investigators working with a small group of students and postdoctoral fellows. But as more and more neuroscientists have been collaborating with colleagues in other life science fields, in physics, chemistry and mathematics, the culture is changing and they are increasingly able to tackle big problems on the scale we are now speaking about.

We are also very fortunate that we now have many neuroscience champions in the policy-making community. As Dr. Holdren has testified, the BRAIN project coordinated by OSTP involves the leaders of many U.S. science funding agencies, as well as some of the most important and influential private philanthropies. It is taking shape under the guidance of a superb group of

scientific advisors and I commend to you the list of suggested topics recently published by the NIH advisory group.

Here in the U.S Congress, there is an active bipartisan Neuroscience Caucus organized by Rep. Cathy McMorris Rodgers and Rep. Earl Blumenauer and includes influential members, such as the subcommittee's Ranking Member Chaka Fattah (D-PA). I can speak from personal experience that Rep. Fattah has been a tireless champion touting the BRAIN initiative wherever he can.

The new interagency brain initiatives have great potential to take advantage of the dramatic advances we have made in the last decade and continue to accelerate progress in all of both basic and clinical neuroscience. They should be embraced and supported as fully as we can.

Mr. WOLF. I am going to go directly to Mr. Fattah.
Mr. FATTAH. Thank you, Mr. Chairman.

INTERAGENCY WORKING GROUP ON NEUROSCIENCE

Let me start, and I thank you for all of your contributions and your written testimony. Let's go first to the work product itself, the Interagency Working Group report. And if you could highlight for the committee what you see as the major recommendations that have come out of this report that will guide our work going forward.

Dr. HOLDREN. Sure. I am very happy to do that. The recommendations in the report span five areas of research policy and communication. First, the brain's information processing capabilities; second, brain diseases, disorders, and trauma; third, interactions between the brain and the environment; fourth, translating research to practice; and, fifth, communication and public engagement.

And in addition to identifying the key scientific challenges and making recommendations in those areas, the report highlights, first of all, a subset of recommendations that can be addressed in the short term without additional funding, which is obviously important in the times we find ourselves in. Those include strengthening the Federal neuroscience framework, including projects that have been initiated through The BRAIN Initiative; initiating a Federally led effort to build translational bridges between neuroscience, cognitive science, and learning across the lifespan; establishing a working group to recommend how current neurobiological information can be used in the classification of brain disorders; supporting efforts to improve coordination and collaboration of Federal research and development agendas in neuroscience, which, of course, is what the Interagency Working Group will continue to do; and establishing a new working group to focus on the impact of over- and under-nutrition on brain development.

There are a number of other activities, obviously, mentioned in the recommendations that would require additional funding. And we kind of hope that that will be forthcoming.

Mr. FATTAH. Well, I would commend the report to the committee, and it will be helpful to us, I think, to help shape our view as we go forward.

INTERNATIONAL COOPERATION

In the last omnibus that we passed, that the President signed over a month ago, the committee had language that would have OSTP under your leadership look to see where in these international efforts there could be collaboration in fields that are strategically important in terms of brain research. So, the Australians, you know, David Abbott is putting up 250 million, the Europeans with their brain initiative is at \$1.5 billion, on top of the other investments that are going to be made out of the Horizon 2020. The Israelis have now said that brain research, at least in terms of brain machine and therapeutics, are going to be their number one investment in terms of research and development.

Where does the United States—see opportunities? The Japanese have done, some very significant work in this regard and are chal-

lenged by many of these same issues, like Alzheimer's and the like. Can you give us a sense of your view about where there could be collaboration?

Dr. HOLDREN. Well, you have mentioned many of them. We are engaged in discussions and interactions with all of the groups you mentioned, with the Japanese, with the European Union, with our British colleagues. Dr. Philip Rubin, who has been leading this work in OSTP, Principal Assistant Director for Science in OSTP, has gone to meetings on this subject with the Japanese. He attended in December of last year a major meeting that our British colleagues put together on this topic. It was a major topic of discussion in the meeting of the science advisors at the G8-plus-5 that I hosted recently. And Dr. Rubin also visited Israel for a meeting on this subject with our Israeli colleagues. I think there is a tremendous amount of opportunity for sharing information.

Mr. FATTAH. Do you get the sense that we could actually work together? The Europeans have a different view, for instance, about how to map the brain. They want to proceed along a kind of computational modeling. How does that compare to the U.S. approach as announced by the President? And do you see where there can be actual collaboration?

Dr. HOLDREN. First of all, there is benefit in diversity of approaches, benefit in comparing notes on progress. And there is also benefit in doing some things really jointly.

Mr. FATTAH. Right.

Dr. HOLDREN. And we are in the process of identifying which things it would make sense to actually work on together as opposed to which things we will continue to work on, on separate tracks but compare notes.

Mr. FATTAH. Take Alzheimer's, for example. The United States spent about \$210 billion last year on Alzheimer's care. Half the patients in the Nation's nursing homes have Alzheimer's. If you take all of the neurological investments we made as a country last year, they amount to—about \$6 billion.

We need to be doing more. Perhaps there is an opportunity for us to have resources like Horizon 2020. The EU says, they are putting these dollars on the table and they want to work with U.S.-based research institutions on these challenges. I am wondering because sometimes in politics we have turf wars, I am trying to figure out in the scientific world where it is easier to work together.

Dr. HOLDREN. I think there is a long and vigorous tradition of international cooperation in science. The President is a strong supporter of partnerships of all kinds, not just international partnerships, but intersectoral partnerships. And as you know, we have very important philanthropic private sector participation in The BRAIN Initiative with the Howard Hughes Medical Institute, the Paul Allen Institute for Brain Research, and the Kavli Foundation. And so we are in the business of leveraging the limited Federal resources that we can bring to bear on this to bring in private resources and to do international collaboration where it makes sense to link our resources with those of other countries.

Mr. FATTAH. We would like to work with you as you go forward in this regard. The executive branch nor Congress wants to conquer this issue. We want to work with you.

Dr. HOLDREN. Absolutely.

Mr. FATTAH. We want this to be a joint initiative. It is a bipartisan initiative. And from the first day there has been bipartisan support, not just from the chairman, but as we have interacted with our other colleagues. As I understand it, this is a challenge that affects almost every family in the country, just on the disease and disorder side. And then when we start to cross over into the cognitive teaching and learning issues, there is a lot to be gained from a better understanding of the brain.

I think the administration has been pushing the country to embrace investments in science. This is an area where we could build support for major investments. The fact is we see our economic competitors making major investments in this area. They are doing so because they see a strategic advantage, not just a need. There is something to be said for leading the effort on the earliest discoveries, better diagnostic tools, and better treatments for various types of illnesses.

OPPORTUNITIES FOR FUTURE RESEARCH

Now, Dr. Leshner, you said in your recent article that this was the neuroscience moment and that we needed to seize it. You lead the largest scientific society. Where do you see the opportunities for both collaboration and for us to do even more than we are doing?

Dr. LESHNER. Thank you. I love that question.

I think there are two things at least going on at the moment that make this a particularly opportune time. First of all, there is the enthusiasm that you all have expressed. But advances in neuroscience are continuing to come at an accelerating rate, both incrementally and in a sort of a step-wise function, what people call quantum changes. And a lot of those quantum changes are coming as a result of new technologies.

We don't yet quite have all of the technologies we need to get into the most difficult questions. But just as one example, in the last 5 years we have seen an increasing application of what is called diffusion tensor imaging, which is a way to literally visualize all of the circuitry of the brain. Think about that. With billions of neurons, to be able to literally look at and trace these circuits is a tremendous advantage because that is how behavior, for example, comes about. So one thing is that the science is going extremely well.

Another is that neuroscience has become a very attractive area for people in other fields. So we are seeing more and more computational scientists coming to work at the intersection with neuroscience. Engineering. So NSF again has this sort of relationship between the biologists and the engineers and is fostering that kind of interaction. Chemistry. Physics. You can't do modern imaging without a physicist in your lab.

And so what I think we are seeing is, first of all, wonderful progress, and everybody ought to be applauding that rate of progress. But the second thing is that all of the scientific community is recognizing it and getting more and more interested in working at the intersection with neuroscience.

Mr. FATTAH. You know, yesterday Francis Collins testified before the Senate. He talked about some of the great science being done

in Alzheimer's research, however these efforts are dying for lack of funding. The notion that something more challenging is what grabs the headline, not the science, underlines the discussion he was making because we really are making some progress.

The committee that we are in front of today, Commerce Justice Science, is just one committee. I want to recognize the ranking member on Veterans' Affairs who just came in. Through his committee, we have done some work in terms of funding epilepsy centers of excellence and other work related to brain research.

The National Science Foundation is at the point of the spear in terms of bringing in other disciplines. The notion that we have to have a collaboration of particular engineers should not be limited to just nanoscientists to really understand how the brain works.

The chairman and the committee provided 14 million for cross-agency work. Please tell us how you are going to proceed at the foundation with the funding provided.

Dr. WINGFIELD. Certainly. We have three major foci for the fiscal year 2014 for the \$14 million. This will include very integrative research, particularly coming out of a program we call BioMaPS, which is the interface of biology with mathematical, physical sciences, and engineering. A lot of the neurotechnology tools are being developed at this interface, and, as Dr. Leshner said, a lot of the imaging techniques cannot be done without physicists and chemists being involved. So we are focusing on those areas with "Dear Colleague" letters to attract the best and the brightest and the most potentially groundbreaking science.

Another integrative research area concerns data. The Biological Sciences Directorate has a lot of interactions with the Directorate for Computation and Information Science and Engineering. We are trying to develop a cyber infrastructure so we can, in the future, integrate extremely diverse types of data and also enormous types of data. For example, the ultimate goal of The BRAIN Initiative to map human brain activity will require enormous amounts of information, and we don't have the machines and the informatics to handle that yet in a way that we would like to.

Furthermore, integrating that with other information from the environment—

Mr. FATAH. Can you take 60 seconds and lay out in layman's terms what you mean by we don't have the ability? I think just to put it in perspective for the record it might be helpful.

Dr. WINGFIELD. What I mean is that we lack informatics techniques to deal with the enormous amounts of data and then make sense of it, so that we can understand how human brain activity responds to physical environments, social economic environments, and so forth.

Mr. FATAH. Thank you, Doctor. Let me, because I am a politician, let me try to do it. You have over 100 billion or so neurons, somewhere in the 89 to 100 billion neurons, with a trillion-plus connections. None of us have the faintest idea exactly how this is designed or how any one neuron does any particular thing at this moment. Not the Nobel scientists, the neuroscientists or neurology or anyone else. So we have a lot of work to do in order to understand how the human brain works. And we are going to need supercomputing at a level that does not exist yet.

Dr. WINGFIELD. There is a lot of work, a lot of research we need to fund.

Mr. FATTAH. I just want to make sure, because when you talk about this in scientific terms it may not translate as well. We need to make it as clear as possible about the challenges ahead. The country has to come to grips with the fact that we are going to need to make more significant investments in this area if we are going to get to the answers that we need.

Dr. WINGFIELD. Quite right. The mission there is to provide the basic foundation, knowledge, and technologies to go down that translational pathway.

Mr. FATTAH. I am going to yield at this time, Mr. Chairman, if you have any questions, or other members.

Mr. WOLF. I do. First I am going to go to Mr. Diaz-Balart.

Mr. DIAZ-BALART. Thank you very much, Mr. Chairman. I think it has been a very interesting presentation. And again I am new on this subcommittee. I have a lot to learn.

Mr. WOLF. It is a great subcommittee.

Mr. DIAZ-BALART. Obviously, Mr. Chairman.

BROADENING PARTICIPATION IN NEUROSCIENCE RESEARCH

Dr. Wingfield, in your testimony you mentioned an NSF-supported workshop titled "Physical and Mathematical Principles of Brain Structure and Function" held at NSF in 2-13. And just looking through that, I saw that many of the workshops of the attendees included private universities and private foundations, some very impressive, by the way, groups. While there were over 30 public universities, about half came from one State alone. And it looked like there was a bit of a lack of diversity from a variety of institutions, including, for example, minority-serving institutions and that kind of thing.

How are those invitees chosen? Do they just come on their own? How does that work?

Dr. WINGFIELD. For those particular workshops the participants were chosen. The typical way we do this is we identify a PI or two PIs and invite them to submit a proposal for the workshop to the Foundation. The proposal is then peer reviewed and a decision is made whether to fund or not. So the scientific community puts together the list of participants, after NSF has reviewed the proposal and made a decision on whether to fund it.

We do try our utmost to ensure that all types of institutions—from research one universities to community colleges—are represented as far as possible. And certainly broadening participation, including underrepresented minorities, is one of our very highest priorities.

Mr. DIAZ-BALART. I know that is part of I guess your mission statement. And my concern would be that as you move forward with the actual investments in neuroscience research that, you know, how are you planning to engage research institutions that, frankly, work with diverse populations, to make sure that the research, obviously the outcomes, you know, more reflect the actual country as a whole. And again I am not being critical, I am just concerned about the fact that you have, you know, out of the 30-plus, you know, half were from one State. And, anyways, I just

want to make sure that you are aware that that is an issue that you have to deal with, obviously.

Dr. WINGFIELD. Absolutely, we are on board with that. May I give one example? The recent Science and Technology Center that we funded, "Brains, Minds, and Machines," has three Minority-Serving Institutions associated with it, and the numbers of under-represented minorities actually doing science there is really impressive.

Mr. DIAZ-BALART. Great. And I commend you for that. And as I just mentioned, remember, I am new at this, so you are going to have to kind of bear with me, all right?

But my understanding is that since The BRAIN Initiative was announced that both DARPA and NIH have announced some new programs as part of that initiative. And the NSF, I guess, either has not or has been a little bit slower, which doesn't necessarily mean a bad thing, but are there new research announcements like that, like those that we have seen from DARPA and NIH, are they forthcoming from NSF? And, if yes—

Dr. WINGFIELD. Yes.

Mr. DIAZ-BALART [continuing]. You know, what should we be looking forward to? And, you know.

Dr. WINGFIELD. Yes. In fiscal year 2014 we have what we call "Dear Colleague" letters coming out. And we have already funded some research coordination networks. We are trying to set the foundation for basic research in the brain for years ahead that will coordinate well with the other agencies, but not overlap or duplicate research. So we are actually funding research right now with direct relevance to The BRAIN Initiative. Solicitations will be forthcoming in this fiscal year.

Mr. DIAZ-BALART. Great. Well, I look forward to it. And again as probably the newest one on this subcommittee, I have a lot to learn. So please feel free to educate me throughout this process.

Dr. WINGFIELD. Those are great questions.

Mr. DIAZ-BALART. Thank you very much. Appreciate what you gentlemen are doing.

Thank you, Mr. Chairman. Appreciate that.

Mr. WOLF. Thank you, Mr. Diaz-Balart.

I have a couple questions we have prepared, but we have heard your thoughts. And I remember the last brain initiative. Maybe you were referring to Silvio Conte.

Dr. LESHNER. I am indeed.

NEUROSCIENCE RESEARCH IN AN INTERNATIONAL CONTEXT

Mr. WOLF. Mr. Conte, he would speak very eloquently in conference on this issue, but then it sort of did go away. Sil, God bless him, died. And maybe when you remove somebody from this process, the Congress, the issue ends. But I remember Mr. Conte used to do that.

We are all concerned about this for so many different reasons. I had a sister-in-law who died of Alzheimer's. You go out to the hospitals and you see the troops who have been engaged in Iraq and Afghanistan. And we all know somebody who has Parkinson's who is struggling, including one of my closest friends.

So as Mr. Fattah said, it goes across every category because we all have a brain. Do we not need international cooperation, almost like a NATO-plus or almost like an International Space Station? I mean, we could even involve the Chinese on this, Dr. Holdren.

Do we not need sort of like an International Space Station whereby there is a major effort so that if this gentleman is working on one thing and you would be working on the other, we know we are transferring findings? Do we not need that? And the Working Group ends in 2014, the end of this year. Is that correct?

Dr. HOLDREN. I suspect that we will recharter it.

Mr. WOLF. So do we then need an international effort or a NATO-plus where we are working with our friendly allies? Certainly, as Mr. Fattah said, the Irish are doing this, Great Britain is doing it, the EU is doing it. Do we need something that is just to coordinate and bring everything together, even though parts are working on different things?

Do we need a major national conference? The other issue I wrote down, where is America in the amount of money that is put in? Mr. Fattah may know. If you were to say objectively, what nation is number one? Are we number one? Or the European Union? I don't know the answer.

So there are three different questions there. Do we need a major International Space Station approach to it? Secondly, who is number one? And number three is, do we need a truly national conference whereby the best minds in the world, not just in the United States, but in the world are brought together perhaps by the end of this year? Mr. Fattah could do a letter asking for a reprogramming of something and bring it together. So there are the three questions that all of you can answer, if you can.

Dr. HOLDREN. Let me take a crack at part of it. I think we do need more international cooperation and communication about what is going on in the different countries. There is a rapid rise in that kind of activity that has been going on. I mentioned a number of the major meetings that have occurred over the last couple of years that we have taken part in. Clearly, there is going to be more.

I am not sure the space station analogy quite works in this domain just because there are so many diverse lines of research and development. There is the development of the tools for imaging the brain, there is the development of the high performance computing and data management capabilities that you need. There are so many dimensions of this that I am not sure we know how to construct a single centralized operation to which the space station might be an analog.

But we sure know how to collaborate on research projects, we know how to merge resources, we know how to partner with the private and philanthropic sectors as well, and do that, even across national boundaries. I think we are going to see a lot more cooperation.

I can't tell you right now who is number one. Again, if you ask who is number one, there are probably many different indices. One index is how much money are you spending. It is even difficult to figure out across the whole government exactly how much money

is in this domain because the boundaries are fuzzy as to what is included and what is not.

Mr. WOLF. I know we are number one in so many areas. But is there any sense of where we are in comparison to one, two, and three?

Dr. HOLDREN. I would be interested in what Mr. Leshner thinks about that question, since he is perhaps coming from a slightly more independent stance than those of us who work for the government.

Dr. LESHNER. So I think, you know, pushed, you would have to say the U.S. remains number one in neuroscience. However, other countries whose overall investments in science are increasing at a rate far greater than ours, are developing. They see this as an opportunity area and have been investing very heavily. So although there is no question in my mind that we are among the most eminent in neuroscience in the world, I don't think we are alone. And there are superb neuroscience communities in Japan, in Great Britain, in the rest of Europe. And so, candidly, I believe broadly that American preeminence in science is at great risk as the budgets in this country and constant dollars have been falling as other countries are increasing their investments.

I would like to just comment on your question about international coordination and collaboration. My own view is that neuroscience among fields is among the most collaborative. I am not totally sure why. Other than the American Society for Neuroscience, the largest aggregation in the world of neuroscientists, which has 38,000 members, draws 35,000 members to its annual meeting. And that annual meeting is one of the most international events that any of us attends. It is a sort of "you have to be at it," and people come from all over the world.

What we don't have is a single organization that is charged with coordinating all of it. But I have to say that I think neuroscience does an excellent job of sort of self-aggregating and self-coordinating and collaborating.

Mr. FATTAH. Mr. Chairman.

Mr. WOLF. Go ahead.

Mr. FATTAH. There is plenty of runway room here for better collaboration. And even if you don't start up at the top where the chairman starts where we have over 100 countries working together on the space station, there is room just in terms of expanding the access to clinical trials, right? The European Union has a joint clinical trials initiative that Israel and Australia participate in. The United States has not joined in yet. There is an opportunity for us.

When you are dealing with some of the rarer diseases or disorders, you need a broader base of people who are afflicted by the disease or disorder that are used for clinical trial basis. So there is room there.

The chairman would not be surprised to learn that there is no agreement across the world about the definition of diseases and disorders in neuroscience. There could be a more uniformed approach.

There is room for us to make progress. I think at the upper echelon of this there really is room for nations to work together. When

the chairman of this committee says to Dr. Holdren that we could bring China to the table for this kind of collaboration, that shows you that there is a lot of opportunities to build a collaboration.

Mr. Culberson is back. I did recognize you. I want to thank you for the work you did with me on the Epilepsy Centers for Excellence, on suicide prevention, and some of the other issues on veterans' affairs. Thank you.

Mr. WOLF. Well, maybe you can all think about it and be in touch with the Committee and Mr. Fattah to see if the Committee could carry that language, particularly because of the role the National Science Foundation plays, which comes under the committee. And, of course, you, Dr. Holdren, in your role of overseeing the entire government.

I think it is an issue that everyone, if they think about it, is interested in. It doesn't get into the battles of reconciliation and shut-downs in government. It is something that we can all come together on. There but for the grace of God go I. Everyone has someone in their family who is facing something.

So if there is some language directing a—you fill in the blank. I am not the expert; Mr. Fattah knows a lot more about it than I do. But I think there is an opportunity to do something and to seize it now, particularly since Mr. Fattah and I are able to get along and we have a great relationship with Senator Mikulski. I had forgotten about it, but Sil Conte's face just came in front of me—did you serve with Sil?

Mr. FATTAH. We should do it now.

Mr. WOLF. We should do it now. We should do it now so that we don't then say, well, we missed this opportunity.

Let us know if there is something that we can carry on either an international or a national conference. Dr. Collins oversaw the human genome project. Who is the Dr. Collins for this?

But you tell us, so that you don't have the political process doing something that doesn't quite work out. The Howard Hughes Center is in my district.

Have you been out there, Doctor?

Dr. WINGFIELD. Yes. We have collaboration.

Mr. WOLF. Have you been out there?

Dr. LESHNER. I have.

Mr. WOLF. It is most impressive.

Mr. FATTAH. I think, Dr. Holdren, didn't you host the G8 science department there?

Dr. HOLDREN. No.

Mr. WOLF. Have you been out there? They don't open up the Hughes Center. I mean, they don't take any Federal funding, I believe.

Dr. LESHNER. They don't need it.

Mr. WOLF. They don't need it.

POTENTIAL EFFECTIVENESS OF HYPERBARIC TREATMENT

The last thing is kind of a personal thing I wanted to ask you about. My sister-in-law had a stroke and was given up for dead. My brother did a lot of things but all the doctors said, nothing will work. He took her to a hyperbaric center, and a couple of the doctors said this is crazy. This is out in Westchester.

Mr. FATTAH. Right.

Mr. WOLF. And the strides and the gains that she has made have been incredible. She was in the University of Pennsylvania hospital. They said it was over.

What do you know about the hyperbaric center? I was at the VA, and they are beginning to look at the hyperbaric program for veterans. What do you know about the hyperbaric treatment process and the impact on the brain? Do you all have any thoughts or knowledge or—

Dr. WINGFIELD. I am aware of that research. I don't have enough facts to give you an answer.

Mr. WOLF. Okay.

Do you know? I have seen this. I mean, they said it was over, finished. My brother took her three times a week. And it is extraordinary. One doctor said, hey, listen, if it makes you feel good, go there. He did, and now we see this unbelievable change. And Penn is a very good hospital.

So what you know about the hyperbaric?

Dr. LESHNER. I don't know a lot about that particular technology, although I do know that there are individual cases where it has been successful.

But one of the things going on in neuroscience is with the advent of technologies and the application of technologies and ways that that we used to think would never work we are starting to see that they are effective for individual people. So deep brain stimulation, the notion—I am a former acting director of the National Institute of Mental Health and director of the National Center on Drug Abuse. An awful lot of what we thought 25 years ago couldn't possibly work, electroconvulsive shock therapy for depression, if done in a different way, works. Deep brain stimulation for Parkinson's disease is now a technique that is being used.

Magnetic stimulation of the brain. We used to think magnetic stimulation would be nothing, or optogenetics Dr. Wingfield made mention of. These kinds of technologies are coming on line, in my point, and being tested in ways where I think a lot of our long-held beliefs are being challenged. Somebody says it can't possibly work. I think many of us have become much more skeptical. In fact, kind of a statement, and I am sorry I don't know much about the hyperbaric.

Mr. WOLF. Well, I tell you, that is why I think Mr. Fattah is on to something here. I have seen the change. Also there is a center now in Lancaster County, Pennsylvania. Remember the Amish killing of the young girls? They go there. My brother has told me about the different changes in all these people.

I had a very close friend that I was referencing who has Parkinson's. I said, about this hyperbaric center. He said, I did and he said it is quackery. It is crazy.

Well, so, obviously, if you like your doctor and he says that, you are not going to go. But the NBA stars do, the hockey stars do, the hockey players do. So God bless these people. The one doctor told my brother, if it makes you feel good, do it. And it has worked.

So I think that is why you need somebody to coordinate the research in such a way that if there is something out there that somebody can tap into, they can try it.

Mr. Culberson.

Mr. CULBERSON. Thank you very much, Mr. Chairman.

RESEARCH PRIORITIES FOR NEUROSCIENCE APPLICATIONS TO
VETERANS

My other committee assignment is the Veterans and Military Construction Subcommittee, and of particular interest is the effect of concussions on our young men and women. Their survival rates are extraordinary today in Afghanistan and Iraq. If they survive the initial injury, they have a greater than 98 percent chance of living. But then many of them are injured terribly with the concussive effect on their brain.

And I wanted to ask about some of the work that Chairman Wolf just mentioned that the VA is doing. Are you familiar with any of the work that is being done at the VA? Are you satisfied with the collaborative efforts that they are making with some of the researchers that you are familiar with in helping to treat these young men and women and recover from the chronic traumatic encephalopathy effects of concussive explosion?

Dr. HOLDREN. Well, I would just say I am far from an expert in this field, but the VA is a participant in the Interagency Working Group. The potential advances that we are looking to achieve through the investments that are being made in The BRAIN Initiative and in the wider neuroscience domain include the potential for really significant breakthroughs in treating traumatic brain injury. That is one of the big flagship approaches, to be able to deal with that really tragic situation that so many of our service people have suffered. And also, as you mentioned, folks suffer these kinds of injuries in the workplace as well.

Mr. CULBERSON. And they are surviving at rates never seen before. So it is extraordinarily important. And many of the effects don't immediately appear. There are examples of young men and women who have been exposed to tremendous explosions and stay conscious.

And then there is one example in an article in Science Translational Medicine from, I think this is—what is the date on this—it is from 2012. This is May 16th of 2012, a 45-year-old veteran who had been exposed to a one-time tremendous explosion, had no effects, did not go unconscious, had some headaches and irritability, seemed to be fine, and then died 2 years later of an aneurysm, but had no prior history. So these things are obviously very mysterious.

The investments that are being made in brain research are so extraordinarily important. And I just wanted to ask if, they are a member of working group, Dr. Wingfield or Dr. Leshner, are you aware of any specific work that is being done with the VA to help these young men and women?

Dr. LESHNER. We do know that the VA has put a major emphasis on battlefield injuries and their effects specifically on the brain. They have made it a major priority. Post-traumatic stress disorder, epilepsy induced by battlefield incidents, and then the effects of concussion, which, of course, can lead to all these other kinds of things.

So the VA has recognized the issue. I just don't know the details of the extent of it. But I have been in meetings where the head of research at the VA has spoken about some of the emphases, and it is a shift for them——

Dr. HOLDREN. We can certainly get back to you, Congressman Culberson.

Mr. CULBERSON. Thank you. That was what I was going to ask. Thank you.

Dr. HOLDREN. We will put together some detailed information on what is going on, on that front, for you.

[The information follows:]

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20502

March 17, 2014

The Honorable John Culberson
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Congressman Culberson:

Thank you for your inquiry, during the February 27 hearing on neuroscience research before the House Committee on Appropriations Subcommittee on Commerce, Justice, Science, and Related Agencies, regarding work being done by the Department of Veterans Affairs and other researchers on traumatic brain injury (TBI) to help military service members and Veterans. The current government-wide strategy driving TBI research for military personnel and Veterans was established in response to an August 2012 Executive Order entitled *Improving Access to Mental Health Services for Veterans, Service Members, and Military Families*. In it, President Obama directed the Departments of Veterans Affairs (VA), Defense (DoD), Health and Human Services, and Education to develop a National Research Action Plan (NRAP) on TBI, post-traumatic stress disorder, and other mental health conditions to “improve the coordination of agency research into these conditions and reduce the number of affected men and women through better prevention, diagnosis, and treatment.” Last August, President Obama released the NRAP, which outlines the coordinated Federal research efforts to spur discovery of the causes and mechanisms underlying these conditions, rapidly translate what is learned into prevention strategies and clinical innovations, and accelerate the implementation of proven means of preventing and treating these devastating conditions.

Of particular relevance to your question, the NRAP identifies the key challenges confronting the TBI research community. It also offers immediate, short-, and long-term milestones toward meeting these challenges and defines a coherent research strategy for the coming decade as the Federal agencies work together to minimize both the incidence and impact of TBI for military service members and Veterans. Congressional support for the National Research Action Plan and the research focus areas it details will play an important role in ensuring these goals are met.

There are a number of priority research areas in the NRAP, spanning the continuum from fundamental research in TBI to clinical care. These include improving diagnostic tools; identifying actionable biomarkers; optimizing recovery mechanisms; improving preclinical modeling; advancing effective treatments, including those for co-occurring conditions; and creating effective assessment tools.

Diagnostic tools and definitions. Current definitions of TBI as well as the tools used to diagnose it are imprecise. There are several interagency collaborations underway to improve the tools and criteria used to classify the severity and type of TBI; for example, the DoD and the Centers for Disease Control and Prevention, in partnership with the Brain Trauma Foundation, are collaborating on an effort to develop a classification system for mild TBI (also known as mTBI, or concussion) that will improve clinical assessment of a patient’s status and prognosis. Research focused on precision classification of TBI and the development of more sensitive diagnostic tools may ultimately enable personalized medicine approaches for treating TBI.

Biomarkers for identification, management, and treatment effectiveness. Preliminary evidence supports the potential for use of bodily fluid (e.g., blood, serum, and cerebrospinal fluid) biomarkers to detect mTBI. Of particular interest are biomarkers indicative of the potential neurodegenerative effects of TBI, such as chronic

traumatic encephalopathy¹ (CTE) and dementia. In order to fully capitalize on this potential, research is needed to evaluate existing and emerging biomarker technologies for their ability to detect injury, predict short- and long-term outcomes, and monitor response to treatment.

Recovery mechanisms. Following TBI, most patients show some degree of improvement over time. Yet, relatively little is known about the mechanisms that underlie recovery or about ways to harness neuroplasticity² to optimize improvements. Research to identify patterns of brain structure and function that are associated with either recovery (or non-recovery) will contribute to improved patient outcomes.

Preclinical modeling. The integration of animal models of TBI, human sample based research findings, and computational modeling has the potential to open new research avenues for understanding TBI, but challenges in collecting human postmortem brain tissue have impeded progress in this area. DoD has established the first DoD brain tissue repository to study TBI in service members. To advance the development and validation of animal models, especially for blast TBI and mTBI, further postmortem human-tissue research will be needed, and efforts to encourage donation of postmortem tissue with appropriate consent will help to advance this research.

Treatment methods. There is limited evidence of the effectiveness of both pharmacological and non-pharmacological therapies, including rehabilitation treatments, for TBI. Rigorous definitions of rehabilitation treatments (to replace commonly used experience-based treatments) are needed, as well as research regarding the customization of therapies to an individual's injury, predisposing factors, and co-occurring conditions.

Assessment. The International Common Data Elements Project for TBI has recommended a battery of "gold standard" outcome measures and assessments for TBI research; collectively these assessments take several hours to implement. A shorter, reliable assessment tool that is both comprehensive and sensitive across the range of injury severities is needed to assess functional outcomes and quality of life following treatment.

Co-occurring and pre-existing conditions. The near- and long-term symptoms of TBI can overlap with many other neurological disorders. Additionally, evidence is emerging that pre-existing factors, including physical, social, cultural, or health-related conditions, affect the course and outcome of TBI. Research is needed to identify effective treatment for patients with TBI that address both pre-existing and co-occurring conditions.

In addition to identifying the critical research focus areas, the 2013 NRAP described specific actions on immediate, short-term, and long-term timescales that Federal agencies will undertake to meet the challenges outlined in these research priorities.

Immediate Actions

- Complete the current DoD-CDC-Brain Trauma Foundation mTBI classification project to clarify what is known about mTBI and identify critical gaps that need to be addressed. Develop a clinical classification system to replace the current "mild/moderate/severe" nomenclature.
- Increase the inventory of scarce research resources (e.g., tissue samples, blood, and cerebrospinal fluid) and facilitate access for scientific purposes with appropriate human subjects' protections for privacy and confidentiality.
- Coordinate a portfolio analysis and collaborate on research projects of shared interest through increased participation in the National Institutes of Health (NIH) Electronic Research Administration system, which provides full life-cycle grants administration functions for the NIH, VA, and several other agencies.

¹ Chronic traumatic encephalopathy is a progressive degenerative disease of the brain commonly found in athletes who have experienced repetitive brain trauma (e.g., concussions); it has also been observed in soldiers exposed to a blast or a concussive injury. The brain degeneration is associated with memory loss, confusion, impaired judgment, impulse control problems, aggression, depression, and, eventually, progressive dementia.

² Neuroplasticity refers to the brain's ability to develop new neural pathways to compensate for injury or disease and to adjust a neuron's activities in response to new situations or to changes in its environment.

- Determine whether point of injury blast and impact sensors can be correlated to mechanism and severity of brain injury.
- Review and report on existing and novel diagnostic tools and treatments for TBI to improve the evidence base for TBI management.
- Coordinate within and between agencies involved in The Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative to ensure a balance of basic and translational science and to enable rapid utilization of mature technologies.
- Continue to support clinical trials that are evaluating the effectiveness of therapies to improve outcomes and quality of life following TBI.

Short-Term Actions (2–4 years)

- Support research focused on systematically characterizing blast neuropathology related to military service and comparing and contrasting it to the neuropathology of impact TBI.
- Develop a better understanding of the quantitative relationship between the level or number of repetitions of blast exposure and severity of TBI in both animal models and humans.
- Determine whether co-occurring and pre-existing conditions exacerbate impact- and blast-related neuropathology.
- Improve the understanding of mechanisms of recovery after TBI and discover ways to harness neuroplasticity to improve outcomes.
- Support validation studies of potential biomarkers and cutting-edge diagnostic tools.
- Continue to support the Federal Interagency TBI Research (FITBIR) Informatics System as a national resource for TBI research data. Enhance the system to include, with appropriate consent, advanced analytical tools and additional sources of data.
- Promote collaboration, meta-analysis, and sharing of de-identified individual TBI study data across agencies where possible, appropriate, and permissible.
- Develop efficient, affordable, comprehensive, valid, and sensitive tools for assessing functional outcomes and quality of life for TBI patients over time.

Long-Term Actions (5–10 years)

- Develop a more precise system for classifying and staging TBI to enhance diagnosis and prognosis and to enable targeted therapies and personalized medicine.
- Determine the acute and chronic effects of TBI as well as the genetic, gender, ethnic, and environmental factors that influence injury susceptibility and subsequent outcomes, including the development of CTE, Alzheimer's disease, and other neurodegenerative diseases.
- Identify causal relationships between posttraumatic alterations in brain function and symptoms, functional outcomes, and quality of life. Evaluate promising pharmacological and non-pharmacological treatments, including rehabilitation treatments, for their ability to improve functional outcomes for TBI patients.
- Develop and test models for team-based, integrated treatment of TBI and co-occurring conditions to improve upon the existing practice of independently treating each condition.
- Conduct research on the social, psychological, and economic effects of deployment-related TBI on military families and on communities.
- Conduct research on the long-term health needs of service members and Veterans with TBI and the resources needed for long-term care and planning.

While OSTP does not maintain a comprehensive list of research in TBI and related conditions conducted at non-Federal institutions, there are myriad research projects ongoing at universities nationwide. The following are representative examples of university-driven studies on TBI and TBI treatments.

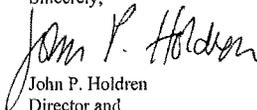
Researchers from Boston University recently published a study examining the connection between TBI and CTE.³ The scientists report evidence for CTE in the brains of military veterans with blast exposure and/or concussive injury that is similar to that observed in the brains of young amateur American football players and a professional wrestler. The study's findings provide evidence of a direct connection between blast TBI and CTE. In addition, the study validates a new animal model for mimicking the neurotrauma resulting from a blast; such a model will be useful for developing new diagnostics, therapeutics, and rehabilitative strategies for treating blast-related TBI and CTE.

The Penn Center for Brain Injury and Repair at the University of Pennsylvania School of Medicine has a thirty-year history in studies of brain injury and treatment. Accomplishments from the Center include the development of novel Magnetic Resonance Imaging (MRI) techniques to improve diagnosis of TBI and the discovery of an anatomical link between TBI and the development of post-traumatic epileptic seizures. Recent work at the Center includes a promising preliminary study on a blood test that may identify when concussion will lead to long-term cognitive disability.⁴

Few drug therapies exist to treat ongoing neurological impairment and inflammation following TBI. Recent research led by a team from the University of Texas Health Science Center and the Houston Medical School suggests that a novel stem-cell therapy may have the potential to provide lasting cognitive improvement following TBI.⁵ While the work by this team so far focuses only on mice, the study indicates that this stem-cell therapy could become a viable treatment for people with TBI in the future.

In closing, I want to emphasize that Congressional support for the National Research Action Plan and the specific research activities it describes will enable advanced understanding of TBI and improve future treatment options available for those affected by it. The Departments of Defense, Veterans Affairs, Health and Human Services, and Education all have been actively engaged in developing and executing the NRAP to coordinate research in TBI and other neurological conditions, with a specific focus on improving prevention, diagnosis, and treatment for service members and Veterans. The NRAP outlines both the major research challenges confronting the study of TBI and specific immediate-, short-, and long-term steps needed to overcome these challenges. I have attached a copy of the NRAP for your consideration and would be happy to work with you and other Members of Congress further on this important issue.

Sincerely,



John P. Holdren
Director and

Assistant to the President for Science and Technology

Enclosures: National Research Action Plan

cc: The Honorable Frank Wolf
The Honorable Chaka Fattah

³ Lee E. Goldstein, et al. *Science Translational Medicine* 4, 143ra60 (2012)

⁴ University of Pennsylvania Health System, Blood Test Accurately Diagnoses Concussion and Predicts Long Term Cognitive Disability (November 2013) (available online: http://www.uphs.upenn.edu/news/News_Releases/2013/11/siman/)

⁵ Supinder S. Bedi, et al. *Stem Cells Translational Medicine* vol.2, no. 12 953 (2013)

Mr. CULBERSON. Thank you. And give me some idea, if you could, specifically where you think, on our subcommittee in particular, in conjunction with Chairman Wolf and Mr. Fattah to make some progress in this area, because it is something of keen interest.

Are you aware of any private universities or private researchers that are making significant progress in this area? I know Baylor University that I have the privilege of representing in Houston, at the Texas Medical Center, has been doing some extraordinary work in this area, as has the University of Texas Health Science Center.

Dr. HOLDREN. We will put together a package—

Mr. CULBERSON. Okay.

Dr. HOLDREN [continuing]. That addresses what is going on within the government and across the research.

CUTTING EDGE RESEARCH OPPORTUNITIES FOR NEUROSCIENCE

Mr. CULBERSON. The BRAIN Initiative that you described is essentially the President, I know under your direction, Dr. Holdren, the amount of money that he is suggesting is being spent is a total of how much?

Dr. HOLDREN. Starting out at a little bit more than 100 million a year. The intent is for that to rise. Obviously, it has to be on a trajectory that makes sense in terms of your capacity to absorb the money in a constructive way with some of these new focuses.

Mr. CULBERSON. That is what is proposed in the budget this year?

Dr. HOLDREN. What is in the budget for 2014 is something around \$100 million. By the way, about the same amount is being put in by the private partners. Howard Hughes, Kavli, and Paul Allen are putting in among them about another hundred million. There are folks who are very vocal about how it needs to be more. We agree that it will ramp up. I can't talk to the 2015 budget at this point, but that will be released next week.

Mr. CULBERSON. Oh, it is next week, you haven't got it yet?

Dr. HOLDREN. No. The 2015 budget is being released on March 4th.

Mr. CULBERSON. Okay. Could you talk specifically, if I could very quickly, then I want to move on, I will come back, is some specific examples if your mind of the most promising areas of research that are being done? What are the most exciting, if you could pick out one or two, cutting-edge, tip-of-the-spear research in your mind have the greatest promise that we should particularly pay attention to?

Dr. WINGFIELD. One area that the NSF is now very interested in is, how do these circuits of neurons work? And then the important next step is, how do all of those circuits integrate together to result in complex behavior, extremely complex behavior that humans show, for example? That is a huge challenge and will be one of our foci over the next few years.

You also mentioned something very interesting earlier about individual variability and how one individual can respond to the same trauma in a very different way.

Mr. CULBERSON. Yes, sir.

Dr. WINGFIELD. That is something we are very interested in at NSF, too. We see that kind of variability across many organisms.

We are now focusing on not so much the golden mean, the average across many individuals, but what is the basis of that individual variation, which could have a huge impact for how you treat specific diseases.

Mr. CULBERSON. Certainly, my opinion, I am no expert, but that is certainly my impression. And Chairman Wolf's personal story is one that we hear all the time of individuals who have responded in remarkable, extraordinary—the power of prayer, good doctors, willpower. Extraordinary. The good Lord designed us to be very resilient creatures. And it is astonishing the ability even of the brain to repair itself and to heal. Each one of us are individual and highly unique. And I do think, I agree with you, that that is extremely exciting.

And one thing I know that Mr. Fattah, Chairman Wolf, and I and the other members of the subcommittee believe I know very strongly is the importance of the Federal funding, and then to do everything we can to get out of your way and let the science lead and try to avoid political interference in what you are doing.

So as you talk about the cutting-edge, tip-of-the-spear research, if I could, Dr. Leshner, the one or two areas that you think are most exciting, and then Dr. Holdren, and then I will pass the witness.

Thank you very much for the time, Mr. Chairman.

Also mention, if you could, to the extent that political—I hope political interference is not causing any problems in the work that you are doing.

Dr. LESHNER. So far so good.

On the latter question, we really have had very little, even when I was running the National Institute on Drug Abuse, where you might suspect there would be the potential at least, I did not experience political interference.

I had the pleasure of chairing a workshop at the Institute of Medicine on grand challenges in neuroscience. So I will keep my remarks as short as I am physically capable in light of that.

So my favorite question is, how does the brain generate a mind? And what is happening now is that with the advent of new technologies, particularly technologies actually that have been developed in the last 5 years, we can actually watch a brain in action. We can watch what is going on in the brain during mental and cognitive events.

And as these technologies get further developed, I think we will very rapidly move to a new level of understanding of how cognitive function is organized in the brain. That doesn't mean it is going to tell us how you get a mind. I think we are decades from that one. But that is my favorite question, because it is really the essence of who we are.

Another issue where I think we are making tremendous progress is the intersection between genetics and environmental influences. More and more we are coming to understand that so many things are influenced by genetics, not necessarily heredity, but by genetic mechanisms. And then what happens is, of course, that the environment impinges on that prepared organism. So you are prepared by your genes and then you live in an environment. And more and more we are coming to understand how the environment modifies

the expression of genes, and that is fabulous. That just gives you insights that we couldn't fantasize years ago.

So I will stop at that. I will behave.

Mr. CULBERSON. Dr. Holdren.

Dr. HOLDREN. I will just say a couple of things. First of all, to echo what Dr. Leshner said about the new tools that are becoming available for visualizing what the brain is doing. These are going to be enormously important. This is the centerpiece of The BRAIN Initiative. And one can't even imagine all the places that this capability is likely to lead us. I think of the analogy with the Human Genome Project where at the time that was begun no one could have imagined, the most knowledgeable people involved in it—Dr. Collins, Dr. Lander, Dr. Venter—couldn't have imagined where this was going to go and what the applications would turn out to be.

My suspicion in terms of some of the outcomes we are going to get: I think we are going to come to understand Parkinson's much better, including ways to treat it better and indeed potentially to cure it. I think we are going to make major progress with the issue you were talking about a moment ago, the traumatic brain injuries. I think that is ripe for advances and going to be enormously helpful.

But I would also say if you look at what we are doing across the Federal Government in neuroscience funding, we are funding a tremendous amount of fundamental research in the various domains that are neuroscience and that impinge on neuroscience. And that fundamental research investment is invariably the seed corn from which applied discoveries are going to grow.

And if I would ask one thing of this committee it is to continue the excellent support you have given for funding these fundamental research domains where you can't tell exactly where it is going to go, but you know that those investments are going to bear tremendously powerful fruit.

Mr. CULBERSON. Absolutely. I am all in.

Mr. WOLF. Mr. Fattah.

FUNDING PRIORITIES

Mr. FATTAH. Yes. First of all, there is some very exciting research going on. But let me just put it in perspective.

In the human brain, there are almost a hundred billion or so neurons. In the brain of a worm, there are 302. We don't know how the worm's brain, or how the neuro network actually works. So we have a lot of room to figure out what we want to accomplish.

I think the chairman's point earlier, is embodied in this notion of a moment, a neuroscience moment, that we want to actually get something done. Now, we are politicians. We have no idea. We are not neuroscientists. We want to get something done that is worth doing. And the language that got OSTP started here was a non-incremental, disruptive progress. This is the committee where we are funding \$8 billion for the James Webb Telescope. It is going to launch in 2018. We are going to know more about how the heavens are constructed than you could ever want to know. Well. Mr. Culbertson wants to know even more.

When we talk about improving imaging tools to see there are three pounds in between our ears, we actually want to know what

it is that you need. We want to help you. We want to see this progress, sooner rather than later. You have a President who has walked into the East Room and said the brain is important. You have an array of leaders around the world who in a time of austerity are putting resources on the table. You have 28 European nations who unanimously agreed to put \$90 billion on the table for the next 7 years on major scientific work, and neuroscience is at the top of the leader board. You got Australia. You have a lot of things going on at this moment.

The chairman came over and sat beside me. His point is that, we need to do this now. We don't want to take a passive approach to this.

Newt Gingrich said that if we could delay the onset of Alzheimer's by, 7 years, it is probably a \$2 trillion proposition for the Federal Government. Not that money is the be all, end all, but because, there are 5 million families dealing with Alzheimer's.

The point is, as a matter of Federal resources and priorities, one could argue this should be a very, very important one. That is my argument. I could tell you a lot about the research. Everything from Paul Allen, who has put up a half billion of his own money. The research he is doing looking at infants and their cognitive capabilities before they ever see a math teacher shows they understand math concepts. The human brain is a magnificent thing. There is a lot going on in terms of restoring the development of neurons in the brain that could have a lot to do with how we deal with dementia issues.

But what we want to know as appropriators is where and what we need to look at given the array of choices we have to make, so that it is more relevant to the challenges that the population faces. That is really what we are trying to get you to tell us. Specifically where we need to make investments. Is it imaging, is it diagnostic tools or basic research? A lot of what we are going to find we are going to find by accident. So we need to do basic research across the board.

Please respond to that. And then I think that we will conclude. We will have some questions for the record.

Dr. HOLDREN. Well, certainly, we will be happy to work with you on the priorities issues, the funding issues. My inclination in this domain is, forgive me, to say all of the above, because virtually everything we have talked about here in the broad neuroscience domain is worthy of additional investments. We know we live in a challenging budget environment, but this does need to be a high priority, and I think when you see the President's 2015 budget you will see that reflected. But we will be happy to work with you on the budget issues going forward.

Mr. WOLF. With that, thank you, Mr. Fattah. We are going to conclude.

Thank you for your testimony.

Sure, Mr. Culberson. Go ahead.

Mr. CULBERSON. I am sorry.

I wanted to specifically follow up and ask, if I could, to put sort of a time limit on getting back to me on what the VA is doing. Because my subcommittee, Military Construction, and Veterans' Administration will be the first one out of the gate. And I really need

to know within the next couple of weeks, where the most promising research in your opinion that is being done through the VA. Because the VA has got the ability, they have got a vast amount of the money. And this whole question of a traumatic brain injury, the encephalopathy, I think it is called, where the brain begins to accumulate fluid after a concussive blast, and the ability of the brain to repair itself.

And something I was listening really, really keenly for and did not hear until Mr. Fattah and then Frank, Mr. Wolf mentioned as well, is the ability of neurons to heal and repair. That is of I think tremendous importance. It is marvelous to be able to image and see what is going on and what makes a mind and how a complex brain activity creates complex physical activity.

But be able to repair neurons. Is the VA able to do anything? Is there any research that is going on that I could help through our subcommittee on VA be able to direct funding to enhance what this subcommittee is doing in helping neurons repair, helping these young men and women recover?

Every individual is unique. This article is astonishing in the work. I have been a subscriber to the journals Nature and Science for 20 years. I can't pretend to understand it all. I read them cover to cover, but don't always get it. There is a marvelous article from November 30 of 2012 on a large-scale model of the functioning brain that you mentioned. It is extraordinarily exciting to see it.

But what research is being done that we can invest in, where, as Mr. Fattah and Mr. Wolf says, can we target our dollars? And I have got a brief window. My bill is going to be the first one out of the gate. We are going to come rocketing out here soon. And I need to know where can I as a subcommittee, where can we target the money at the VA to do the best work to help these young men and find ways to repair the mind when it is injured or damaged.

Dr. HOLDREN. I am not sure we can tell you how to allocate the VA budget, but we can certainly give you a picture of what is going on in terms of the research in which the VA is involved, academic research, as you have mentioned that addresses these questions.

Mr. CULBERSON. What is the most promising.

Dr. HOLDREN. And perhaps we can offer some judgments on what is really promising.

Mr. CULBERSON. Yeah, most promising. And then give me your personal—

Mr. FATTAH. I am going to share some information with you too, Mr. Chairman.

Mr. CULBERSON. Please do. And we will work arm in arm on this.

Mr. FATTAH. As we have.

Mr. CULBERSON. As we have and will continue do. But really this is going to happen quickly.

Dr. HOLDREN. I hear your time scale. We will try to work to that.

Mr. CULBERSON. Right. And happen rapidly. And thank goodness, we are going to get all 12 appropriations bills this year.

Thank you, Mr. Chairman.

Mr. WOLF. Thank you. Since there has been an agreement on the budget, I don't think you will go through the whole process you have gone through the last couple years. This thing will move very, very fast, the markups will. He will be out of the chute first.

So on the funding level, I think we are going to be okay here. But I also think there are process issues, too. That is also something that the Committee has the ability to carry language on. We have enough money to do something, but how do you then do it? So you can come back with process suggestions. Literally, I think before we get to the end of March, we are going to really have to have it.

Mr. FATAH. I do want to thank Dr. Rubin and his team for the great work they have done at OSTP under your leadership.

Dr. HOLDREN. I will pass that on. Thank you.

Mr. WOLF. Great.

With that, thank you for your testimony. Hearing is adjourned.

Questions for the Record for Dr. Holdren

Office of Science and Technology Policy Reponses to Questions for the Record from Chairman Frank R. Wolf Subcommittee on Commerce, Justice, Science, and Related Agencies

1. The Interagency Working Group on Neuroscience (IWGN) has been operating since 2012 and produced several deliverables as outlined in the group's charter. In all of that time, however, only one report has been issued to describe the IWGN's progress and findings, and that report was just released at the end of February. Why has the group been slow to make its products publicly available? Is it your intention to continue providing public reports to describe any future activities or findings of the IWGN?

The IWGN is chartered under the Committee on Science of the National Science and Technology Council (NSTC). NSTC working-level discussions and interim work products are deliberative and therefore not released to the public. Due to the broad interest from the community and from members of this Committee in particular, the IWGN was asked to prepare a report that could be widely disseminated. The result is the document released in February 2014, *Priorities for Accelerating Neuroscience Research through Enhanced Communication, Coordination, and Collaboration*.

Moving forward, the decision to prepare and publicly release reports on IWGN activities will be considered by the Working Group and Committee on Science on a case-by-case basis.

2. What role, if any, did the IWGN play in the development of the FY 2015 budget request? How do the individual agency budget requests reflect the priorities and actions recommended by the IWGN?

NSTC groups, such as the IWGN, do not have budget formulation within the scope of their activities. Therefore, the IWGN did not play a role in FY 2015 budget development. Each Federal department, agency, or office develops its own budget in coordination with the Office of Management and Budget, and the White House Office of Science and Technology Policy (OSTP) provides the coordination overlay for interagency science and technology activities.

Many members of the IWGN hold leadership roles within their Federal departments, agencies, or offices and participate in the budget development process. In addition, the IWGN participating agencies followed an interagency concurrence process for approving the Working Group's report.

3. OSTP has promoted a larger neuroscience agenda that includes the IWGN as well as the BRAIN initiative and the White House Neuroscience Initiative, which covers efforts on mental health services and Alzheimer's treatment. What is the relationship between these various activities? Who is ultimately controlling and coordinating all of them as a consolidated whole?

Under the direction of OSTP, the White House Neuroscience Initiative coordinates and supports neuroscience and mental health-related activities directed by the White House and seeks opportunities to build upon and coordinate across established efforts within Federal agencies. By

identifying strategic opportunities to work across agencies and promote collaboration between the Federal Government and the private sector, the White House Neuroscience Initiative aims to increase the positive impact of Federal investments in neuroscience to improve health, learning, and other outcomes of national importance.

The White House Neuroscience Initiative includes or supports a number of activities, each focused on different aspects of the neuroscience or mental health sector. These components include:

- *The Interagency Working Group on Neuroscience (IWGN)* - With the encouragement of Congress, including members of this Committee, the IWGN was chartered by OSTP in June 2012 under the National Science and Technology Council's Committee on Science; the IWGN's goal is to coordinate activities across the Federal government in the areas of neuroscience, cognitive science, learning, and development.
- *The National Alzheimer's Project* – The National Alzheimer's Project coordinates Alzheimer's disease research and services across all Federal agencies; accelerates the development of treatments that would prevent, halt, or reverse the course of Alzheimer's disease; improves early diagnosis and coordination of care and treatment of Alzheimer's disease; improves outcomes for ethnic and racial minority populations that are at higher risk for Alzheimer's disease; coordinates with international bodies to fight Alzheimer's and other neurodegenerative diseases globally; and developed an integrated national plan to overcome Alzheimer's disease.
- *The Executive Order on Mental Health* - The President issued an Executive Order (EO) in 2012 to address prevention, diagnosis, and treatment of mental health conditions affecting veterans, service members, and military families. The EO strengthens suicide prevention efforts, enhances access to mental health care, increases the number of Veterans Affairs mental health providers, promotes mental health research and development, and launches a Military and Veterans Health Interagency Task Force to address these issues.
- *The National Research Action Plan (as directed by the Executive Order on Mental Health)* – The 2012 EO on Mental Health also directed Federal agencies to create a coordinated National Research Action Plan on mental health. The Departments of Defense, Veterans Affairs, Health and Human Services, and Education developed a wide-reaching plan to improve scientific understanding; provide effective treatment; and reduce occurrences of Post-Traumatic Stress Disorder, Traumatic Brain Injury, various co-occurring conditions, and suicide.
- *The Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative* – The BRAIN Initiative is a Grand Challenge launched by President Obama in April 2013 to revolutionize our understanding of the brain. Through this Initiative, the Defense Advanced Research Projects Agency (DARPA), the National Institutes of Health (NIH), the National Science Foundation (NSF), and more recently, the Food and Drug Administration (FDA) support the development and application of innovative new technologies that can create a dynamic understanding of brain function and its relationship to behavior.

4. It has been suggested that the BRAIN initiative could do for neuroscience what the Human Genome Project did for genetics. How apt is that comparison? How might the BRAIN initiative resemble or differ from the Human Genome Project in terms of its overall size, scope and schedule?

The Human Genome Project had a huge impact on the field of genomics, helping to drive down the cost of sequencing the human genome from \$100 million to \$1,000. The BRAIN Initiative could have a similarly transformative impact on the field of neuroscience by developing technologies “that will enable researchers to produce dynamic pictures of the brain that show how individual brain cells and complex neural circuits interact at the speed of thought.”

One difference between these two efforts is that the challenges associated with The BRAIN Initiative (e.g., mapping the circuits of the brain, measuring the dynamic patterns of electrical and chemical activity within these circuits, and understanding how their interplay creates human cognitive and behavioral capabilities) are arguably more demanding than those that faced the Human Genome Project. Although it will be possible to identify progress towards these goals, they do not have the same level of specificity as the goal of the Human Genome Project, which was to sequence all 3 billion base pairs of the human genome.

5. The outlines of the BRAIN initiative beyond fiscal year 2014 are still relatively undefined; there don’t seem to be any overarching goals in terms of total funding or the length of that funding commitment. When should we expect to see a more concrete multi-year plan for the implementation of the BRAIN initiative?

Given the magnitude and scope of The BRAIN Initiative, the agencies involved are taking a measured approach in developing long-term goals and programmatic direction by soliciting input from experts and the broader community. For example, NSF has supported several planning and prioritization workshops on thematic areas related to The BRAIN Initiative, such as *Physical and Mathematical Principles of Brain Structure and Function* (May 2013), *Mapping and Engineering the Brain* (August 2013), and *Phylogenetic Principles of Brain Structure and Function* (October 2013). Building on the output of community workshops such as these, as well as the advice of the National Science Board and Directorate Advisory Committees, NSF recently launched a new website detailing the thematic areas it has identified as Foundation priorities and the funding opportunities for related research. (For more information, see www.nsf.gov/brain).

To develop the scientific plan for NIH’s investment in The BRAIN Initiative, NIH established a working group of external scientific advisors and *ex officio* members from NIH, NSF, DARPA, and FDA. In September 2014, this Working Group of the Advisory Committee to the NIH Director released an interim report identifying high priority research areas that are the critical first steps in supporting the mission of The BRAIN Initiative. Using the report’s recommendations as a guide, NIH released six funding opportunity announcements. The Working Group’s final report, due for release in June 2014, will contain a multi-year scientific plan, including recommendations for timelines, milestones, and cost estimates for NIH’s

investment in the Initiative. (For more information, see <http://www.nih.gov/science/brain/index.htm>).

DARPA recently announced their first three new programs in support of The BRAIN Initiative. DARPA is developing technologies that will improve the understanding and treatment of brain injury and neuropsychological illness for American veterans and service members through neural interface technologies driven by deeper understanding of brain function. The initial set of programs includes Systems-Based Neurotechnologies for Emerging Therapies, which seeks to develop new neural interfaces to measure how system disorders manifest in the brain and precisely deliver therapy in humans with neuropsychiatric and neurologic diseases; the Restoring Active Memory program, which will develop neuroprosthetics for memory recovery in human patients with brain injury or dysfunction; and the Neuro Function, Activity, Structure, and Technology program, which will apply novel optical methods to acquire in real-time measurements of brain structure, activity, and behavior.

Moving forward, OSTP will use these agency-identified research priority areas as a means to facilitate interagency coordination of The BRAIN Initiative and define the long-term future for the Initiative.

6. It is my understanding that the BRAIN initiative had its origins in a private sector effort called the Brain Activity Map, which was briefed to White House officials and adapted into the BRAIN initiative, rather than being developed or coordinated through the IWGN, which was created for that purpose and was operational at the time. Why wasn't the IWGN involved in the development of the BRAIN initiative? How does the IWGN participate now in BRAIN initiative planning and implementation?

The BRAIN Initiative emerged from the convergence of growing scientific opportunities and public health needs, and ultimately was shaped by a variety of activities and interests. For example, the Initiative builds on nearly a decade of Federal agency activities including NSF-supported workshops on the frontiers of fundamental neuroscience research; the NIH Blueprint for Neuroscience Research, the collaborative framework defining challenges and cross-cutting areas of neuroscience research across the 16 NIH Institutes and Centers; and DARPA's interests in understanding how neuroscience affects human behavior or how brain-computer interfaces may improve the lives of wounded soldiers learning to use computer-controlled prosthetics. During this time, scientific breakthroughs included advances in optogenetics and imaging modalities used in the connectome, bringing the field to a critical juncture where investment in a dedicated neuroscience initiative would enable substantial progress to be realized.

Another factor shaping the development of The BRAIN Initiative was a series of meetings convened by a broad group of scientists from around the country and private sector organizations; these discussions resulted in a proposal called the Brain Activity Map, but this initial effort was felt to be too restrictive in scope. This interest in the topic by leading scientists, technologists, and philanthropic foundations, coupled with the IWGN's influence on related

efforts across the Federal agencies since 2012, further elevated the profile of the issue and helped provide the critical mass of participation necessary to launch this national-scale initiative.

There is strong overlap between the leadership of the IWGN and key players in the neuroscience activities within the Federal agencies. All of The BRAIN Initiative's participating agencies are represented in the IWGN. Senior officials from NIH, NSF, and DARPA were involved in the Administration's decision to proceed with The BRAIN Initiative and in the development of the scientific and technical agenda for the Initiative. The IWGN continues to play an important role in supporting this initiative and in identifying cross-cutting national research and development priorities that would benefit from neuroscience research outcomes, with particular focus on brain health and recovery and fundamental research on learning, cognition, and education.

**Responses to Questions for the Record from the Honorable John Carter
Subcommittee on Commerce, Justice, Science, and Related Agencies**

1. How can we ensure that federal investments in biomedical research along with large scale brain mapping yield not just new data but lead to actual treatments?

One of the five focus areas of the February 2014 Interagency Working Group on Neuroscience (IWGN) report, *Priorities for Accelerating Neuroscience Research through Enhanced Communication, Coordination, and Collaboration*, specifically addresses this need to translate basic research results to useful clinical advances. The two activities recommended to address this particular challenge are:

- Establish a working group to convene Federal agencies interested in promoting the application of neuroscience research in clinical or educational settings and its potential commercialization. The group would formulate best practices that ensure an efficient therapy development pipeline.
- Develop a publicly accessible Federal clearinghouse of resources and information for facilitating translation to accelerate the process, ensure timely and cost-effective translation through the regulatory review process, and minimize redundancy.

In addition, two recently announced programs from the Defense Advanced Research Projects Agency (DARPA) are directly focused on developing new medical technology. The Restoring Active Memory (RAM) and Systems-Based Neurotechnologies for Emerging Therapies (SUBNETS) programs are expected to deliver novel discoveries leading to new treatments for memory loss and neuropsychiatric illness.

2. What are the interagency cooperation and coordination policies of the BRAIN initiative? What efforts are being made to provide transparency on how taxpayer dollars are being spent?

OSTP is overseeing interagency cooperation and coordination of the agencies involved in The BRAIN Initiative. To the degree appropriate, the IWGN will also play a role in supporting and coordinating the ongoing Federal neuroscience activities, including interfacing with The BRAIN Initiative. In addition, individual agencies collaborate outside of these formal mechanisms. For example, DARPA is actively engaged with the Food and Drug Administration on new innovation pathways for medical device innovation as part of its SUBNETS and RAM programs; DARPA also is seeking partnerships with the National Institutes of Health (NIH) to establish intramural experimental testbeds to facilitate discovery science and clinical testing.

Both the NIH and the National Science Foundation (NSF) have online databases that provide information on the research projects that they fund. NSF recently launched a new Web site providing an overview of its role in The BRAIN Initiative, <http://nsf.gov/brain>. DARPA also has information on its Web site describing the programs it is currently funding under The BRAIN Initiative. In addition, open science and data sharing are requirements on all new DARPA BRAIN Initiative projects in order to provide transparency and speed translation of new

knowledge from the bench to medical therapy. DARPA's new programs are designed to make the output of scientific investment in brain research yield a capability that can be returned to the American public.

Questions for the Record – Dr. Wingfield

The Honorable Frank R. Wolf

Chairman, Subcommittee on Commerce, Justice, Science, and Related Agencies

Questions for the Record

Hearing on Federal Investments in Neuroscience

Witness: Dr. John Wingfield

1. NSF has decided to support The BRAIN initiative primarily through existing programs that can be used to address neuroscience research rather than creating something new just for BRAIN awards. What is the rationale behind this strategy? How will you control the direction of the initiative if its implementation is spread out across many different NSF programs?

NSF's key strength regarding The BRAIN Initiative is that it currently funds neuroscience research and technology development relevant to The BRAIN Initiative through successful programs across a very wide range of science and engineering discipline areas. As NSF has written in our recent budget requests, a central challenge is to integrate the approaches, skills, knowledge and results from across these disciplines to accelerate progress on understanding the brain. In essence, a new transdisciplinary research community must be developed. NSF is fortunate to have many existing funding mechanisms to draw on immediately to promote this integration and workforce development at the investigator level, including Research Coordination Networks, research centers, workshop support, as well as domestic and international training opportunities. In FY 2015 and over the longer term, as this transdisciplinarity and integration develops, opportunities may arise to create specific, targeted opportunities related to The BRAIN Initiative as appropriate.

In order to drive the above cross-disciplinary integration in the science community, NSF has taken steps to enhance the Foundation's own internal coordination. Beginning in FY 2012, NSF established several internal bodies to coordinate the Cognitive Science and Neuroscience cross-cutting activities, including The BRAIN Initiative. This coordination has been outlined most recently in our FY 2015 Budget Request, and includes NSF's engagement in interagency neuroscience activities. A high-level Steering Committee on Understanding the Brain is staffed with a senior representative from each participating directorate and reports regularly to NSF senior management. The Steering Committee oversees two working groups, one devoted to The BRAIN Initiative and the other to the additional research areas pertaining to cognitive science and neuroscience. These working groups are staffed by cognizant program officers representing each participating directorate, and are charged with identifying priorities, appropriate funding approaches, and mechanisms. For instance, The BRAIN Initiative Working Group developed the set of NSF-specific research foci for The BRAIN Initiative that were reviewed by the Steering Committee, approved by NSF senior management, and posted on the new NSF website "Understanding the Brain", www.nsf.gov/brain. Finally, NSF's representatives on the NSTC Interagency Working Group on Neuroscience (IWGN) are members of either the NSF Steering Committee (including one of the IWGN Co-Chairs and the IWGN Executive Secretary) or one of the two above working groups.

2. How comprehensive is the cognitive science and neuroscience crosscutting theme in NSF's budget? Are there any significant cognitive science or neuroscience activities at NSF that are not included in this theme and, if so, why? What is the relationship between the BRAIN initiative budget line item and the cognitive science and neuroscience budget theme?

The Cognitive Science and Neuroscience cross-cutting theme is broad and comprehensive, with participation of five science and engineering directorates. There are no relevant scientific areas that are specifically excluded from this broad activity. Thematic areas and goals are defined and discussed in the Cognitive Science and Neuroscience narrative in the NSF-Wide Initiatives section of the NSF FY 2015 Budget Request.

New requested funds for The BRAIN Initiative activities fall within the Cognitive Science and Neuroscience umbrella: in FY 2015, NSF is requesting \$29 million for new Cognitive Science and Neuroscience activities, \$20 million of which will be devoted to activities related to The Brain Initiative.

In keeping with the technological emphasis of The BRAIN Initiative as announced by the President, the NSF's thematic activities for The BRAIN Initiative are mainly concentrated on development of enabling technologies, experimental and computational methods, models, and comparative and integrative approaches for accelerating the detailed study of the brains of humans and other organisms. A Dear Colleague Letter issued in March 2014 to solicit research ideas to enable innovative neurotechnologies to reveal the functional and emergent properties of neural circuits underlying behavior and cognition elicited almost 600 responses. The majority of these were cross-disciplinary, multi-investigator, and NSF specific.

The Honorable John Carter
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on Federal Investments in Neuroscience
Witness: Dr. John Wingfield

1. How can we ensure that federal investments in biomedical research along with large scale brain mapping yield not just new data but lead to actual treatments?
2. What are the interagency cooperation and coordination policies of the BRAIN initiative? What efforts are being made to provide transparency on how taxpayer dollars are being spent?

Since these questions were directed to both NSF and OSTP, the OSTP response includes the pertinent input from NSF.

The Honorable Mario Diaz-Balart
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on Federal Investments in Neuroscience
Witness: Dr. John Wingfield

1. Dr. Wingfield, as you move forward with investments in neuroscience research, how are you planning on engaging research institutions that work with diverse populations so that your research outcomes can be more complete and more reflective of the country as a whole?

NSF does its utmost to ensure that all types of institutions — from major research universities to community colleges — are represented as far as possible. NSF is committed to developing a diverse STEM workforce by increasing access for currently underrepresented groups to STEM education and careers through our investments in research and education.. For instance, the recent Science and Technology Center that NSF funded, "Brains, Minds, and Machines", has three Minority-serving Institutions associated with it.

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NASA Request and Oversight of NASA Security

Richard Thornburgh

Panel Chair National Academy of Public Administration

Administrator Charles F. Bolden Jr.

National Aeronautics and Space Administration

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Acting Director Dr. Cora Marrett

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Dr. John P. Holdren
 Director, Office of Space and Technology Policy

Dr. John C. Wingfield
 Assistant Director, Directorate of Biological Sciences, National Science Foundation

Dr. Alan I. Leshner
 Chief Executive Officer, American Association for the Advancement of Science

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