

COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS FOR 2016

HEARINGS BEFORE A SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS HOUSE OF REPRESENTATIVES ONE HUNDRED FOURTEENTH CONGRESS FIRST SESSION

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COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS FOR 2016

TUESDAY, MARCH 3, 2015.

DEPARTMENT OF COMMERCE

WITNESS

HON. PENNY PRITZKER, SECRETARY, DEPARTMENT OF COMMERCE

Mr. CULBERSON. The Commerce, Justice, Science Appropriations Subcommittee will come to order. And we are delighted to have with us today the Commerce Secretary.

Secretary Pritzker, we are delighted to have you. Thank you for your service to the country. And as you present the President's 2016 Department of Commerce budget request, we are just delighted you could be with us today and really genuinely appreciate your service to the country.

You have many important responsibilities of the department including obviously promoting trade and dual use technologies, making sure those are not exported improperly, helping economically distressed communities, administering our patent and trademark laws, preparing for and conducting the decennial census, advancing the measurement of science standards and technology, and forecasting the weather and protecting and researching our oceans which is extraordinarily important.

And we will, of course, work with you to do everything that we can to be sure that each one of your important responsibilities are adequately funded, but it is important to point out that the department's request proposes discretionary appropriations totaling \$9.8 billion which is a total of \$1.3 billion higher than last year.

And your request proposes increases for nearly every Department of Commerce program. And in light of the sequester and the difficult circumstances budget-wise that we find ourselves in, it is not a realistic budget proposal. It also assumes a number of different fee and tax increases which are simply not going to happen.

The subcommittee will not have an allocation that is sufficient to fund this excessive level of spending. While we recognize the important work that you do and we will work with you and the Members of the Committee to meet the resource needs of your highest priority programs, we have to find savings and reduce spending for lower priority or ineffective programs. Our current budget environment will simply not allow everyone to get everything that they want.

We look forward to hearing from you about how we can help you improve the management of the department and to ensure that Commerce employees, for example, are not abusing tele-work programs.

We heard earlier from the inspector general. Our first hearing of the year was from the inspector general and the weather satellite programs. We want to make sure they meet their cost and schedule milestones.

And the 2020 census, we want to work with you to make sure that the cost of the 2020 census is less than the last census and to find out how you are prioritizing cyber security and protecting the department from the ever-growing threat of cyber attack.

We will do, as I say, all we can to help you, but we are going to have to prioritize and cut wherever we can. I do appreciate your service to the country.

And I want to, before we proceed, recognize my colleague, Mr. Fattah, for any remarks he might wish to make.

Mr. FATTAH. Thank you, Mr. Chairman.

And I want to thank the Secretary for the extraordinary service that she has provided to the Nation. Having spent a great deal of time in the private sector to take on this role at this time I know is a major sacrifice but has helped our country.

So we now have 59 months of straight consecutive job growth and over the last 11 months, we have seen job growth of 200,000 or above each month. And we hope that when the February numbers are made public that we will continue to see this trend moving in the right direction.

This country, this economy in which you are the chief custodian for has generated more jobs than the rest of the developed world combined. And so you have done a great job under some challenging circumstances.

We welcome you to the committee. And I know that my colleagues on the other side always talk about dynamic scoring. In your case, it is kind of like dynamic investing. If we invest in job growth, we can reap the rewards. And we look forward to hearing about your budget request. Thank you.

Mr. CULBERSON. Madam Secretary, we will, of course, without objection enter your statement into the record in its entirety and welcome your testimony to summarize your statement. And if you could, keep your statement to five minutes. Thank you very much, and we are pleased to recognize you.

Secretary PRITZKER. Thank you very much.

Chairman Culberson, Ranking Member Fattah, and Members of the committee when they arrive, thank you for this opportunity to lay out the priorities of President Obama's fiscal year 2016 budget for the Department of Commerce.

This budget advances the core tenets of our department's mission which are to develop and implement policies that support economic growth, enhance our country's competitiveness and global leadership, as well as strengthen America's businesses both at home and abroad.

To support this mission, the fiscal year 2016 budget provides \$9.8 billion in discretionary funding to reinforce the priorities of the department's strategy, our open for business agenda, by pro-

moting U.S. exports, trade and investment, by spurring high-tech manufacturing and innovation, by unleashing more data for economic benefit, by gathering and acting on environmental intelligence, and by making our agencies' operations more efficient and effective.

Today I want to highlight some key initiatives supported by this budget. First the Census Bureau. The Census Bureau creates data products used by businesses, policymakers, and the public.

And this budget reflects the fact that this is a critical year for preparation of the 2020 census as we test the use of administrative records, re-engineered field operations and Internet data collection, create new systems to improve the quality of the census and develop plans so that in fiscal year 2017 and 2018, we can conduct an integrity test of the entire process, all leading to a potential savings of \$5 billion to taxpayers. To achieve these savings, we must invest today.

Another part of our agenda is to help communities and businesses prosper in a changing environment. NOAA's budget will enhance our ability to meet this goal through two investments.

First, the budget proposes \$2.4 billion to fully fund the next generation of weather and environmental satellites. Funding the development and launch of future satellites is absolutely critical to reduce the risk of a potential gap in the weather data in 2017 and beyond.

Second, the budget requests \$147 million to develop a high-endurance, long-range ocean survey vessel. Immediate action is necessary to maintain our critical ocean observing capabilities. Making this investment this year will enable NOAA to take advantage of the navy's design work and project management team which will save taxpayers millions of dollars in acquisition and design costs.

For generations, manufacturing has been a key to U.S. innovation, a source of middle class jobs and a pillar of our global leadership. Over the last five years, America's manufacturers have added more than 870,000 jobs, growing for the first time in decades.

Recognizing the importance of manufacturing to our competitiveness, Congress passed the Revitalize American Manufacturing and Innovation Act which calls for the expansion of the National Network for Manufacturing Innovation or NNMI.

This initiative brings together industry, university researchers, community colleges, NGOs, and government to accelerate the development of cutting-edge manufacturing technologies.

Our fiscal year 2016 budget requests funding first to support and coordinate current and future NNMI institutes and second to support two institutes led by the Commerce Department which would focus on manufacturing technologies that industry determines have the most potential.

This budget will also provide the International Trade Administration with the resources needed to advance President Obama's robust trade agenda and to help U.S. businesses expand their exports and reach the 95 percent of customers outside of the United States.

Finally, our budget requests \$24 million for the renovation of the department's headquarters to enable us to make better use of our space and ultimately to reduce the amount of funds required to house our employees.

These priorities only scratch the surface of our department's work to support U.S. businesses, communities, and our economy.

I look forward to answering your questions today and to partnering with this committee to keep America open for business. Thank you.

2020 CENSUS

Mr. CULBERSON. Thank you, Madam Secretary.

I wanted to ask you a couple of questions about the census. I have a lot of constituents who are concerned about the American Community Survey, the intrusiveness of it in a lot of areas, and, of course, the survey response is currently mandatory.

Is that statutory or by your internal administrative rules that the survey is mandatory? I think it is administrative rule, but it is mandatory.

Secretary PRITZKER. I am not sure.

Mr. CULBERSON. I think it is——

Secretary PRITZKER. It is mandatory by statute. I think it is by statute.

Mr. CULBERSON. It is mandatory by statute. So we would need to change the law in order to make it voluntary?

And I notice also there is a lot of overlap between the information that the community survey asks and information, for example, that the Internal Revenue Service already has.

And the estimate, I know that the Commerce Department is predicting that the survey is planning for the census in 2020 to cost less than the last census, but the estimates show that the cost of the census is going to be nearly \$13 billion. We just simply do not have \$13 billion to spend on a census.

So one way it seems to me that is the straightforward way to save money is to use other branches of the government to provide some of that data, and so many of the questions that are asked in that long census could be obtained from the Internal Revenue Service.

Have you worked with the Authorizing Committee on this? What are you planning on doing in order to ensure that you are using information already collected by other branches of the government to bring down the cost of the census?

Secretary PRITZKER. So, Chairman, you know, one of the major efforts that we have with the 2020 census is the use of what we call administrative records, the ability to use other data that has been collected by the Federal Government.

What we need to do in order to take advantage of that information is we have to test the efficacy of using that. And so that is why our request is so significant this year. It is very much about testing.

The 2010 census, as I understand, was pretty much done the way censuses have been done for the prior 30 or 40 years. What we need to do is to transform the way we do the census. And you very much are suggesting that which is that we have more automation and greater use of administrative records. And so we very much want to use other administrative records. What we need to do, though, is test that that will work.

In terms of the American Community Survey, we respect the privacy and time, of the individuals who fill out the American Community Survey as well as the time that we ask people to take to fill out the survey.

It is a survey, though, that is very much used by businesses, by NGOs, by local, state and Federal Government. The VA, for example, is a big user of the American Community Survey. It is the only source of data in many instances for small and rural communities.

So if the ACS were no longer available or no longer used, there is about 60 million Americans that we would not be collecting data on except during the census period.

But recognizing the concern about this survey, I did last year call for complete top to bottom review of the survey, what other sources of information could we be using, how frequently do we have to ask questions, could we ask them less frequently and still have the data be reliable, could we delete questions.

And we are in the process of analyzing that and the answers are due back to me at the latest by the end of the fiscal year.

Mr. CULBERSON. So you will be using, for example, information from the IRS to help you fill in some of the blanks?

Secretary PRITZKER. I do not know the exact sources of the administrative records that we are allowed to use. And some of that is by statute what we are allowed to use.

Mr. CULBERSON. But you anticipate using IRS records?

Secretary PRITZKER. We would anticipate using whatever is available to us. We will have to check whether we can use——

Mr. CULBERSON. Can you use IRS records?

Secretary PRITZKER. I do not know, but we will find out. I will get back to you, Mr. Chairman, on whether we can use IRS records. Obviously what we want to do is use whatever administrative data and records are available to us. And there is a whole list that——

Mr. CULBERSON. Right.

Secretary PRITZKER [continuing]. Census is accessing.

Mr. CULBERSON. I ask for a couple of reasons. A, obviously you want to try to save money by using administrative records that are collected by other agencies, but, B, I am a big believer in privacy and our most important right as Americans is to be left alone which is why I am concerned about the American Community Survey.

It is very long and intrusive and it is treated as though it is mandatory. I understand that it is statutory. That is something we in Congress ought to change because fundamentally the census ought to just be who are you, how many people live there, what is your, you know, ancestry,—very simple, straightforward questions.

I am also concerned about whether or not privacy advocates are aware that you may be using IRS records with the problems that the IRS has had recently about targeting people. I am concerned about the privacy angle and I do want to know whether or not you will be using IRS records.

Secretary PRITZKER. Mr. Chairman, we will get back to you. Privacy is something that we at the Census and we at the Department of Commerce take very, very seriously.

We work very hard to protect the data that we have the privilege of having access to and we work very carefully to make sure that it is being handled in a responsible fashion when we do the things that we are required to do either by statute or by the Constitution.

Mr. CULBERSON. I understand another way you will be trying to save money is with allowing people to log on and handle a lot of this online. And if there are 140 million households estimated to participate in the survey, you are going to have a lot of people visiting the Web site. The Obama Care Web site had about 250,000 visitors before it just completely melted down.

What are you doing to prevent something similar from happening to the Census Web site?

Secretary PRITZKER. So we are in the process of beefing up our systems to be able to handle the volume. But the other thing that we need to do is make sure that we—we are equally as concerned about the issue of verification to make sure that when we send out a survey, a census survey, someone knows that it is us, it is the government, it is the Census Bureau. It is not someone else.

And we also will need to have methodologies to authenticate that the person responding is actually who they say they are.

There is a lot to be dealt with to make sure that this works online well. It brings me back to what is important is that the Census Bureau very much wants to take advantage, as you said, of how do we save money, how do we do this efficiently.

But to do that, we have to invest today. We have to be able to test because if we cannot prove that it is going to work, then we are now allowed by, you know, as I said, what I call the lock-down or the integrity test that will occur in fiscal years 2017 and 2018.

If we cannot prove to the Census folks that this will work, we are not able to do the census that way. Then we go back to the more expensive survey which is sending people to people's houses which seems ridiculous in a digital world.

Mr. CULBERSON. Thank you.

You know, we just simply will not have the money this year. It is going to be a very difficult budget environment.

Secretary PRITZKER. No, I understand.

Mr. CULBERSON. Thank you very much.

Mr. Fattah.

MANUFACTURING INITIATIVE

Mr. FATTAH. Well, let me first of all, Madam Secretary, ask you about the manufacturing initiative. One of my priorities on the subcommittee over the last few years that I have been the ranking member has been the MEP program, the Manufacturing Extension Partnership, the Hollings legacy around manufacturing extension using the same basic method that was used in the agriculture extension to apply to our manufacturers.

Now, we have seen arrested by this Administration the major losses that we were seeing in this sector. In fact, I recall in the first weeks of the Administration economists aggregated together on the pages of the New York Times saying how this could not work and manufacturing could not come back.

And the Administration has shown that this was a fallacy, that in truth manufacturing has led the recovery. And you said it is

800,000 jobs, but there is more for us to do. And I have talked to you about this.

I am particularly interested in how this intersects with the other work of our subcommittee because we invest in science. And the chairman and I have a great interest in science.

But I am interested to make sure that American innovation, that is American ideas are connected to American jobs, that when we have the spinoffs from our space program and other programs in which intellectual property is allowed to be used mainly for free by companies to create wealth that we require in the licensing of this intellectual property that whatever jobs it created are created in the United States of America.

And the committee has done some work in this area in the past, and I have a continuing interest to make sure that where we invest in a national lab, where we invest in NIST or NASA or NOAA that when there are new widgets that those widgets get manufactured whether in Texas or Pennsylvania or some other place, California, New York, and Washington State.

But the point here is that there is no reason why taxpayer-financed research, even though it may create wealth for some innovators, and I think that is wonderful, I am all for it, but that the jobs that go with it should benefit Americans and the Americans that we are taxing to make the initial investment into science.

So if you could talk a little bit about that, that would be helpful.

Secretary PRITZKER. Congressman, you know that I am as passionate about manufacturing as you are and I view my number one responsibility is to help our economy grow and help our private sector grow because one thing I know from my own experience 27 years in the private sector is that the people who create jobs are the private sector.

And so one of the things you talked about, the Manufacturing Extension Partnership, and, as you know, we are re-competing our MEPs at this time and we have just done ten of them, and the reason that we are doing that is and the reason that MEP exists is to help small and medium-size manufacturers.

And if you had told me from the private sector before I had this job that the Federal Government could help you to have better access to technology and processes to manufacture, I was highly skeptical until I went out and actually saw this with my own eyes and, more importantly, talked with owners of businesses who said I would not have been able to adapt the kind of world-class processes that I have access to because of the Manufacturing Extension Partnership.

So these are programs that I think are extremely effective. We have changed the funding match to be one to one so more small businesses can take advantage of it. And it is something that, you know, is really exciting to see the kind of specialized expertise that a small manufacturer can take advantage of.

In terms of other efforts that we have around innovation, whether it is the Centers of Excellence in terms of that NIST has working on disaster resilience or forensic science or advanced materials, these are areas where we work with outside universities to take technologies, move them forward so that they can get out of the laboratory sooner rather than later.

The National Network of Manufacturing Innovation is a continuation of that effort to take ideas that we think can go from lab to market over the next five to seven years, and that is why I was so excited when you all passed the Revitalize American Manufacturing Innovation Act because it is an opportunity for us as a country to really put together our researchers in the universities, our private sector, our local governments, our NGOs, our community colleges and the supply chain and the skilled labor training that can go on in our community colleges to take technologies like lightweight materials or take technologies like photonics or digital manufacturing and really bring them to market.

And the reason we need to do that is we know that a third of our economic growth since 2009 has come from our innovations. And so it is really critical.

Mr. FATTAH. Thank you, Madam Secretary.

I saw the red light come on and I think that—

Secretary PRITZKER. Sorry.

Mr. FATTAH [continuing]. Means that—no—that I will wait until the next round to ask a follow-up. No, we are going to try to follow the rules.

Mr. CULBERSON. Thank you very much.

Ms. Herrera Beutler.

Ms. HERRERA BEUTLER. Thank you, Mr. Chairman.

Madam Secretary, I wanted—

Mr. FATTAH. Could the gentle lady introduce the young one?

Ms. HERRERA BEUTLER. Sure. This is my daughter, Abigail. She used to be quiet and you could just drag her anywhere. And now she just babbles, so I thank the Chair for his indulgence. Babbling that people like, right?

Okay. I wanted to bring up an issue that is not wholly your purview, but it is something I would like you to be aware of and would very much appreciate your assistance and your thoughts. So I want to get it right. Let me stick to my notes.

GROUND FISH BUYBACK LOAN

Fishermen in Washington State and along the West Coast have been under a challenge since about 2003 under the groundfish buyback loan. We feel that the terms of the loan are punitive and so we moved in a bipartisan fashion to change that.

And it was actually the end of last year with the NDAA passage and the President signed into law provisions that fully refinanced that loan at rates that other businesses get which we feel like is a little bit more appropriate.

The implementation of the law has been held up, though, with the Office of OMB, which we will be bringing it up as well, claiming that either the funding must come out of NOAA's budget or a new appropriation is required which Congress did not feel like that was necessary. That is why we were able to move it, quite frankly. The bill was fully offset in the NDAA, so we felt like we had provided what we needed to.

So what we are seeing is a challenge within the Administration where the money is going to come from. And the law was passed. The offset was in it. I, quite frankly, do not care whose budget it comes out of. I just would like to make sure that it is addressed

and that the law is followed in conjunction with the Congress and the President's signature.

So if you have a comment, great.

Secretary PRITZKER. I would just say I am well aware of this issue.

Ms. HERRERA BEUTLER. Oh, great.

Secretary PRITZKER. And I know it is important to you. And I understand my staff is working with your staff and the committee's staff to try and get this addressed.

FISH STOCKS

Ms. HERRERA BEUTLER. Great. I think that is what we would like. We would just want to make sure that it gets taken care of and that, you know, recognizing the offset was there. And it is nice to see everybody behind you, yeah. Okay. I know how that works as a former staffer.

And I brought this up with the OIG as well. The salmon hatcheries, switching issues on the Columbia River are funded through the Mitchell Act and which supports recreational and commercial fisheries in the rural communities. I am along the Columbia River and then out to the Pacific Ocean, so that is almost my entire district. They provide a lot of jobs and resources in my local area.

I was really upset to see NOAA requested a decrease of nearly \$3 million to the salmon management account and those reductions actually target the Mitchell Act Hatcheries. So even under level funding, we know that the number of fish released is decreasing and the costs are going up.

Moreover, the funding needed to ensure that the hatcheries are maintained is being undermined and we are seeing the consequences of fish losses from failed equipment.

So despite all these facts, NOAA states in their budget that a document that they are able to—in their funding document, they believe they are able to meet their obligation for operation and maintenance and their obligation to meet their hatchery reform responsibilities.

But given these facts, I am not sure how NOAA is going to be able to do this, and I guess I would love comments that you have on that because this is another big one.

Secretary PRITZKER. Making sure that we have adequate salmon stocks and that this fish stock is doing well is of great importance to us. What I would ask is that I would probably have my NOAA staff work with yours to explain to you how exactly we believe—we believe this is adequate funding to do what we need to do, but I would like to have them come and work with you so that you can be satisfied about that.

Ms. HERRERA BEUTLER. Absolutely. Mitchell Act funding for these hatcheries is key and so we want to make sure what we are hearing on the ground corroborates with what your NOAA staff are seeing and hearing.

My time is just about up. I just want to put this on your radar. Hatchery genetic management plans which are required under ESA, and we can go into a little bit more detail, again, I do not want to run out of time, but I am concerned about the backlog. I think I have seen over 100 are due and we do not have them. So

we will bring that up with your staff as well, but those are kind of my top three.

Secretary PRITZKER. Terrific. We will look into it and we will work with you.

Ms. HERRERA BEUTLER. Thank you. Appreciate it.

With that, I yield back.

Mr. CULBERSON. I yield to my colleague and good friend Mr. Serrano from New York.

2020 CENSUS—IMMIGRATION REFORM AND TRADE OPPORTUNITIES

Mr. SERRANO. Thank you. And thank you, Madam Secretary, for being here today and for your work. I am going to ask you two quick questions at the same time because they are based on hopes. It might be that by the next time the Census comes around we may have immigration reform. While what that means to the Census Bureau, other than people coming forth to be counted that perhaps were afraid to do so before, you know, are we ready for that? Will it be a big challenge or something you have to be ready for? And secondly, my second hope, which seems to be coming to be, is that by pretty soon we may have full diplomatic relations with Cuba which may entail a lot of trade. And the Commerce Department will play a role. Are you ready to meet that challenge if that comes your way? Simple questions, but historic in nature.

Secretary PRITZKER. Yes. Well Congressman, I too hope that we have immigration reform, comprehensive immigration reform by the time, certainly hopefully before the next 2020 Census. And I assure you we stand ready to be able to handle that regardless of when it comes into fruition. It will not affect the processes that we use, it simply is the number of people that we count.

In terms of Cuba diplomatic relations, which is also as you said historic and something that as the Department of Commerce we have been proud to play a role in. You know, we are working on the regulatory aspects of, and the licensing aspects particularly in the area of telecommunications where there is an opportunity for certain goods to be sold into Cuba. And so I am looking forward to having the opportunity to visit Cuba later this year.

There is an embargo in place. We respect the embargo. But it does, the current laws do allow for certain items to be sold into Cuba to the private sector particularly in the area of telecommunications. I think there will also be some agricultural opportunities now and banking opportunities.

CUBAN TRADE MARKET OPPORTUNITIES

Mr. SERRANO. Right. Without telling me anything I am not supposed to know, although we are supposed to know everything, right? What items does the Commerce Department think the Cubans would be ready to sell us other than to flood us with great baseball players and great music and so on, which is great. But we know what we can sell to Cuba. We have been doing it little by little. But what would we be interesting in getting from them in that kind of trade?

Secretary PRITZKER. You know Congressman, I have not studied the opportunities for two-way trade in the way we should. But I am

sure that is something that our International Trade Administration will be looking into and I am happy to do more research for you.

Mr. SERRANO. All right. Thank you. One last question since I do have time. The chairman is interested in cigars, by the way, in case——

Secretary PRITZKER. I think it is \$400 worth of cigars you can buy?

Mr. SERRANO. That is right.

Secretary PRITZKER. I think that is the limit right now.

Mr. SERRANO. That will end, hopefully.

Mr. FATTAH. Well I am sure the chairman and the ranking member will be glad to go with you——

Mr. SERRANO. Right, very, that is true. Very quickly——

Mr. FATTAH [continuing]. Allocation if you got the chairman some cigars, you know what I mean? I hear that, Judge, I am sorry.

Mr. SERRANO. Are you charging me for this time? No, but anyway. No, it is not. Madam Secretary, in 2010 the Census received a lot of criticism and feedback around how respondents of Hispanic or Latino origin were able to self-identify. How if at all has the agency considered making changes to this area? Are there any plans to expand the existing response categories of Mexican, Mexican American, or Chicano, Puerto Rican, Cuban, and other Hispanic, Latino, or Spanish origin? And have you been in conversations with any groups concerning those changes or petitions for changes?

Secretary PRITZKER. Well Congressman, we are committed to accurately measuring how people self-identify their race and origin. And we tested an approach in 2020 and we are building on the research of that in twenty—we tested in 2010 and we are building on that for 2020. We have been actively working with stakeholders and in fact we have just put out a big Federal Register notice on this issue. So we are trying to make sure that we get this accurate, get this right. Because we are very much committed to an accurate Census.

Mr. SERRANO. Thank you, Mr. Chairman.

Mr. CULBERSON. Thank you very much. Judge Carter.

EXPORT INITIATIVES

Mr. CARTER. Thank you, Mr. Chairman. I apologize for being late. I have got a bill on the floor. Thank you very much for being here. I am from Texas, as my colleague from Texas pointed out, and energy export remains a major driver of the Texas economy. The Obama administration's regulatory policies threaten to impair this vital part of our trade economy. How does your agency expect our nation to be able to expand trade to reach foreign markets if the regulatory burden here at home cripples those industries? And with these concerns in mind what are the challenges to encouraging direct foreign investment in domestic industries?

Secretary PRITZKER. Well I will start with the last part and then talk about our export initiative. But first in terms of foreign direct investment, we run a program called SelectUSA. In fact, I am quite excited, I got a report on, an update this morning about SelectUSA. This is the first ever effort by the federal government of the United States to welcome investment by foreign companies into the United

States. And what we do know is about 5.6 million Americans today are employed by U.S. subsidiaries of foreign companies.

So SelectUSA is both, is populated by people in 32 key markets that we want to attract investment from, and we also put on a summit. Our foreign commercial service officers that work on SelectUSA are helping those companies invest here in the United States and then we have staff here in the United States helping them navigate our federal system. But obviously we do not prefer one state over another.

Then we also run a summit once every 18 months. The second annual summit will be March 23rd and 24th. You are all invited. We will have about 1,200 attendees. The goal is 2,500 attendees and about 1,200 companies to join us for that. These are companies interested in investing in the United States. So we have a robust effort to reach out to foreign companies to invest in the United States.

In terms of helping American businesses export, that falls under our Foreign Commercial Service and our U.S. Export Assistance Center and our National Export Initiative which we just revitalized this year. We took a look at what we have been doing over the last three or four years and tried to update it to grow exports. And you know we hit record exports this year at \$2.35 trillion. So we work both to attract foreign direct investment as well as helping American businesses, particularly small and medium sized businesses, that need help to understand well what market our U.S. Export Assistance Centers, of which there are 108 I think in the United States, they help American business identify what countries their products are competitive in. And then our Foreign Commercial Service Officers, which are in 75 countries around the world, help those companies then navigate the local regulations, the local rules, etcetera, to be able to do business there.

Mr. CARTER. Oh, you did not answer my question about the, the United States regulatory burden and how it affects trade and commerce.

Secretary PRITZKER. Ah. Well, to date what we are finding in terms of interest in investing in the United States, it is extremely high. We are the number one place in the world, by A.T. Kearney, by Goldman Sachs, to invest in the U.S. So in terms of regulatory burden it does not appear that that seems to be an impediment at this time for companies being interested in investing in the U.S.

But President Obama has asked his head of OIRA and each and ever one of us running our departments to look at our regulatory burden and to assess whether on a cost benefit basis, whether our regulations are working and are worth it and are effective. And we have been doing that here at the Department of Commerce. For the most part that would affect, for example, two different areas. First fisheries, how does it affect our fisheries and how we regulate our fisheries? And the second area is really our licensing at BIS. At BIS we, if you have a dual use product that we are trying to sell outside the United States there is what is going on is what is called export control reform. Something like 30,000 plus items have gone from being really restricted to being sold outside the United States to a much lower standard, which is what we manage. And so BIS has gone from 24,000 licenses in fiscal year 2013 to our esti-

mate in fiscal year 2016 of about 50,000 licenses a year. So we are trying to lower the regulatory burden to encourage exports as well as foreign direct investment.

Mr. CARTER. Thank you, Mr. Chairman.

Mr. CULBERSON. Thank you, Judge. Mr. Honda.

NNMI SITE SELECTION

Mr. HONDA. Thank you, Mr. Chairman. And thank you for being here, Madam Secretary. You made the comments on the NNMI and on MEP, which were very positive and we are grateful for that. Under the NNMI you in your testimony indicated that the Department of Commerce would be looking at two selections for sites and I was just curious as to how is that choice, how are those choices going to be made? Who will be part of that? And do you know when these choices will be effective?

Secretary PRITZKER. Well assuming that we get funding for two institutes then what we would do is we would run an open topic federal funding opportunity that would be posted. And then what we would do is consider the results of the FFO and we would structure the FFO that would take into account the recommendations that the PCAST has made, you know, the President's Advanced Manufacturing Partnership has also made. They have recommended various technologies. The idea being our goal is really to have industry decide what are the technologies that ought to be in the Department of Commerce institutes as opposed to at the Department of Defense and the Department of Energy they are choosing the technologies that they would like to see go from lab to market. We view that our role would be more to take our cues from industry.

Mr. HONDA. And based upon that process, then, the outcome if the decisions would make more clear the sites or the regions that—

Secretary PRITZKER. That would help determine topics and then we would use those topics to determine, to run a competition where consortia would come together regionally. It seems that to date the consortia being put together, they are pretty broad actually in terms of their geography. They tend to end up locating one place but the groups that come together tend to often be broad based upon the researchers needed to bring the ideas from lab to market.

Mr. HONDA. Okay. I have always been one to make sure that we fully fund this process so hopefully we move forward on a fully funded—

Secretary PRITZKER. I hope so, too.

SEQUESTRATION AFFECTS ON PTO

Mr. HONDA. On the USPTO we were fortunate to have the Department of Commerce locate in Silicon Valley. And which city, that was arm wrestling among the cities in the district. But we were very fortunate to have USPTO place the office there. Having said that, since that selection was made sequestration came in. And USPTO is fully funded through fees, which is not part of the tax dollar budget process. However, in spite of the fact that it is fully funded by fees it was affected by sequestration. How will you help us build a firewall around that fund so that if there is another

episode of sequestration that we can build a firewall around agencies that are fully funded by fees and not be affected by sequestration?

Secretary PRITZKER. Well sequestration, you know, was very destructive to the Department of Commerce and particularly destructive to the Patent and Trademark Office. In terms of its effect on the Patent and Trademark Office, basically when sequestration came down the only real flexibility in terms of cutting that we had at that time was to cut our investment in IT. And so first of all it was sort of a double whammy. If you think about it PTO, as you said, is fully funded by fees. So the idea of sequestration does not make any sense because I do not know where that money went to but it is not accessible to PTO. But folks seeking a patent or a trademark put up fees in order to get their patent and trademark adjudicated, so that is kind of nuts. And the second thing is that our IT systems, it is really critical, we are working now on something called patent end to end. One of the issues that is often brought up about our Patent and Trademark Office is its backlog, or how long until we have a first adjudication and how long until a final adjudication. We have a target of ten months to first adjudication, and 20 months to final adjudication. By, if we were to have sequestration and then not have access to the money that third parties have paid as fees in to actually adjudicate a patent, the thing that would probably get cut is our systems. And the systems are the very things that help us actually expedite, systems and training and number of patent adjudicators, are kind of the three inputs to how fast you can do patent adjudication. So it would kind of be a double whammy to the Patent and Trademark Office. So I am certainly hoping that we can come to a budget as opposed to end up with sequestration.

How we protect against that, I think that falls under——

Mr. HONDA. The administration?

Secretary PRITZKER. We do not have that control. That falls under——

Mr. HONDA. Well it was OMB that decided, as far as I understand. And since you are part of the administration I would hope that——

Secretary PRITZKER. I will fight, I will——

Mr. HONDA [continuing]. The term that is nuts is, you know, communicated to the administration. Because it is nuts. I mean it is, first it is fee-based. So those who are wanting their patents processed. And it is an economic engine for more jobs and for the economy. So I would hope that we start that discussion within the administration in the case of sequestration that we have that firewall built in early.

Secretary PRITZKER. Congressman, you are probably more knowledgeable about this than I am because fortunately I have basically lived with a budget as far as I have understood it. And so if it is up to me to argue that with OMB, I will argue like all get it. I would love the support of you all. And if it is up to you I sure hope we can work this out. So I look forward to not finding ourselves in that situation because I do think it is nuts.

Mr. HONDA. I think not only California but Texas is also impacted by patents, so.

Mr. CULBERSON. We are in the middle of a vote. We have got 13 minutes, and I would like to recognize Mr. Kilmer.

HATCHERY AND GENETIC MANAGEMENT PLANS

Mr. KILMER. Thank you, Mr. Chairman. And thank you, Madam Secretary for being here. And thanks for coming out to Washington State recently. We loved having you.

I wanted to follow up on some of the points that Ms. Herrera Beutler had brought up, specifically with regard to NOAA. NOAA obviously plays a big role in our salmon recovery efforts and the Marine Fisheries Services has an obligation to ensure that programs comply with the Endangered Species Act. And one of the ways in which it does that is through the Hatchery and Genetic Management Plans. And without approval of those I am concerned that the hatchery managers are subject to significant risk of litigation which could potentially have very severe implications for our recovery efforts, for federal tribal trust obligations, and for the \$9 billion West Coast Fishery. So I have heard a number of concerns from stakeholder about concerns that NMFS lacks the work force that it needs to process these plans in a timely manner and I wanted to get a sense from you what steps is NMFS taking to address the issue?

Secretary PRITZKER. So this year we are seeking to increase the number of staff devoted to the hatchery plans review from two to six, and we are also reprioritizing some of the existing staff to assist with the reviews and analysis. So we are taking it very seriously to be able to try and address these challenges.

Mr. KILMER. Thank you. It is certainly a big area of concern in our area.

INTERAGENCY TRADE ENFORCEMENT CENTER

I also wanted to ask about the International Trade Administration. The President's budget calls for a \$6 million increase in funding to the Interagency Trade Enforcement Center, a multiagency effort to address unfair trade practices and barriers that impede U.S. exports. So how has that Interagency Trade Enforcement Center affected the administration's ability to identify and challenge unfair trade practices? And how will that funding increase affect the ability of American made goods and services to remain competitive internationally?

Secretary PRITZKER. So what ITEC does is it really helps us identify areas for enforcement and then also does research for cases during enforcement. And what we need is we need more language proficient trade analysts. We need more subject matter experts, so that the budget calls for 15 new positions. And you know, fundamentally in a world where we have more trade agreements we need more enforcement because we have folks that are trying to avoid and evade our trade agreements.

IT PROCUREMENT

Mr. KILMER. Thank you. You touched on, with my time remaining, you touched on IT issues. There are a number of members of Congress, myself among them, who are very interested in IT pro-

curement reform. Your department and a lot of departments are significant purchasers of technology. But I think there is concern about whether there is adequate coordination between bureaus on what is procured. And so your department and other departments often will purchase products that they already own, or do not benefit from economies of scale, lack interoperability among products. So are there any internal initiatives that you can share with us that would eliminate some of the redundancy in IT programs and ensure, you know, a more coordinated and standard based approach to IT procurement?

Secretary PRITZKER. Yes, thank you for asking. You know Congressman, when I arrived our IT situation was, pretty good at the bureaus but really pretty awful at the Office of the Secretary and in kind of the central office, if you will. We have been fortunate to be able to bring in a new CIO and he has really put together a plan overhauling not just our security risk management but also our procurement. So he is working with our Chief Financial Officer, who is sitting behind me, to understand what are our opportunities for bulk buying of equipment, of software, of different programs. And in fact I have already seen in certain software that we have needed to use for customer management, that process come into effect. I am not saying we are where we need to be, I am suggesting that we have a really strong initiative in place to really better manage this effort. But we have work to do.

Mr. KILMER. Thank you. And I yield back. Thank you, Chairman.

Mr. CULBERSON. Thank you very much. I really just want to zero in on one area where I think we will wrap up after this.

Mr. FATTAH. That is correct. And I have one ten-second area.

Mr. CULBERSON. Okay.

Mr. FATTAH. Do you want me to go first?

Mr. CULBERSON. Go ahead, sure.

Mr. FATTAH. As we discussed when we met, I am very interested in working with you to pursue the neurotechnology sector as an industry. I am going to be in Israel next week, in Tel Aviv, at the BrainTech Israel Conference. But there is a growing industry internationally, but America leads, and we should continue to focus on how to develop these businesses focused on brain related health issues. And I look forward to an opportunity as you indicated for us to put together some of the industry representatives with you to talk about what we can do as a country to work in this space. All right? Thank you very much.

Secretary PRITZKER. I look forward to that.

NTIA'S ROLE IN THE INTERNET

Mr. CULBERSON. Thank you, Chaka. I want to ask about the Internet. The National Telecommunication and Information Administration has contracted with the Internet Corporation for Assigned Names and Numbers since as I recall almost the beginning of the Internet when the Defense Department first ran it, but it has always been controlled by the United States. This is an American owned company. And the administration recently came out with a proposal to shift that over to a global multi-stakeholder model. What would be the role of foreign governments and international organizations like the United Nations in the new planned model?

Secretary PRITZKER. Mr. Chairman, the goal of this is not to be a government run effort, this is meant to be a multi-stakeholder effort. And just let me step back for a minute. Our role, NTIA's role, has been one of stewardship. We are committed to a free and open Internet. And what we have done is set up. I met in fact this week with the head of ICANN. We laid down a set of criteria that are absolutely essential to be met before we would give up our stewardship role at this point. One is it has got to be a reliable multi-stakeholder model that is not government-led. It has got to be able to do its function of providing a secure, stable, and resilient Internet domain name process. It has got to be able to service its customers. It has got to be able to support an open and free Internet. So we are waiting now for their proposal back as to how they would do that and also how they would assure that governments are not going to highjack the Internet.

Mr. CULBERSON. But a multi, when you say multi-stakeholder, that includes either foreign companies or foreign governments' involvement either directly or indirectly?

Secretary PRITZKER. Multi-stakeholder is just what it sounds like. It is a broad group of constituents in the Internet world but it is not meant—

Mr. CULBERSON. International?

Secretary PRITZKER. Yes, it is international.

Mr. CULBERSON. International, that is what I was concerned about.

Secretary PRITZKER. Right.

Mr. CULBERSON. Because the Chinese, of course, are aggressively censoring the Internet. I am strongly opposed to this FCC regulation that just came out, I am deeply concerned that this regulation that the FCC has just come out with is going to put the government in a position to regulate the Internet like a utility and the Internet has thrived because it is free and unregulated. What role would countries like China have, or companies owned and operated within China have in the administration of the Internet under this proposal?

Secretary PRITZKER. So Mr. Chairman, that is what we are waiting for a proposal to understand is—

Mr. CULBERSON. From?

Secretary PRITZKER. From ICANN. Our role is in the IANA transition. IANA is the domain name process. We supervise that process. ICANN actually runs that process today and we have a supervisory contract with them. And what we are suggesting is that we would ultimately let that contract expire, unless the criteria that we have set up are put in place. And we are waiting for ICANN, which is who does the role now, to give us a proposal that would satisfy us that the Internet cannot be hijacked by foreign countries or foreign companies, and that the Internet remains free and open.

Mr. CULBERSON. I just want to make sure I understood. The proposal you have asked them to come forward with—you have asked them to come up with a proposal that involves foreign-owned companies?

Secretary PRITZKER. There will be foreign players, yes. There will also be domestic players involved.

Mr. CULBERSON. Okay. Thank you. That is what I wanted to establish. I will have additional questions I know for the record. If, of course, Mr. Fattah, you have additional questions?

Mr. FATTAH. No. But I do think on this Internet matter, just so we can get some clarity at some point, we should just do a meeting and have a briefing——

Secretary PRITZKER. Happy to——

Mr. CULBERSON. Good idea.

Mr. FATTAH [continuing]. So that all of us can understand exactly what is going on. Because I think——

Secretary PRITZKER. I would be delighted to have the opportunity——

Mr. FATTAH. Right. So that we can——

Mr. CULBERSON. There is a lot of concern.

Mr. FATTAH. Right. Yes.

Secretary PRITZKER [continuing]. To bring myself and my experts here and we go through it in detail.

Mr. FATTAH. But the chairman's offices will arrange it. But we will——

Mr. CULBERSON. Sure, we will set it up.

Mr. FATTAH [continuing]. Just have a meeting, not a hearing, and get to the details.

Mr. CULBERSON. Because there is a lot of concern. Our constituents, Judge, I know yours are as well concerned about this.

Secretary PRITZKER. Chairman, I share your concern. So this is not something that we are going to let happen, whereas I said there is not going to be a hostile takeover of the Internet.

Mr. CULBERSON. Well I assure you, Congress will help make sure that does not happen too.

Secretary PRITZKER. Good. Thank you.

Mr. CULBERSON. Thank you very much for your time and your service to the country, and the hearing is adjourned.

The Honorable Chairman John Culberson
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on the Department of Commerce FY 2016 Budget Request

Census - American Community Survey

In 1790, the Census asked just six questions. Now, with the American Community Survey, Census asks 72 questions—if you count multi-part questions, that number swells to 124. Many of these questions are invasive, and I've heard from my constituents who say census workers are harassing them and threatening them with fines.

Question: Why does the Federal government need to ask all of these invasive questions?

Answer: The American Community Survey (ACS) is the only source of quality, comprehensive information about our people and the socio-economic contours of our nation. It is the foundation of our national information infrastructure that provides information on age, race, children, veterans, income, skills, housing, and so on. The ACS is used extensively by our communities, businesses, and governments to make better decisions that make our country stronger.

The ACS is vital to small and large businesses to better serve a full range of markets, find workers with the needed skillsets, and inform decisions on where to invest and create jobs. Local communities rely on the ACS to locate schools, first responders, roads, hospitals, and to target resources to areas in need of assistance. The federal government uses the ACS to distribute over \$400 billion a year in federal funding to our communities, in addition to using the ACS to make our government run smarter and more efficiently. There is no substitute for the ACS.

Question B: Response to this survey is currently mandatory. Can survey participation be made voluntary?

Answer B: The American Community Survey is the only source of reliable and comparable data for all rural areas and all small population groups. A voluntary ACS collection would have a negative impact on the reliability of the data, especially for rural and small communities. When Canada switched to a voluntary survey, they lost the ability to publish data for many rural counties. To compensate for a similar effect here, it would cost approximately \$90 million more annually to maintain our current data quality under a voluntary response.

We understand the concerns respondents have and are working to address them. We are also exploring the possibility of using other data sources including information people have provided to the government and commercial entities which could allow us to remove some questions. In addition, we are researching how we might better phrase some of our questions to not only reduce concerns for those who may be sensitive to providing information, but also for those that find them confusing. Further, we are researching the possibility of asking some questions every other year, or every third year, as well as asking some questions of a smaller sample of respondents. Finally, we are experimenting with our interviewing protocol to identify ways we

can make fewer in-person contact attempts to obtain interviews as well as place fewer calls to respondents while still gathering the data our nation needs. In 2013 we reduced telephone follow-up contact attempts by 1.2 million calls. We will also be providing more information in the survey on why we ask each question and how it benefits the respondent and our nation.

Question C: Can the data be obtained by the private sector?

Answer C: The Decennial Census, including the American Community Survey, is a uniquely Federal function required by the U.S. Constitution. Every year, Census and ACS data are used to distribute over \$400 billion in Federal funding; much of it to state and local governments. The American Community Survey collects consistent, comprehensive, and comparable information for every state, county, and city—both urban and rural—and utilizes the existing management, survey design, data collection and processing infrastructure of the Census Bureau to do this. No other agency or private firm currently has the capability or capacity to do this on a national scale in such a way as provide data of the same quality and timeliness, and they could not gain such abilities without substantial cost.

2020 Census

The 2010 Census cost approximately \$13 billion. The Census Bureau plans to reengineer the 2020 Census to hold the cost per household to below that of the 2010 Census. Currently the Census Bureau's cost models predict a lifecycle cost of \$12.6 billion for the 2020 Census. I want to make sure that the 2020 Census is both accurate and less costly than the 2010 Census. We don't have \$13 billion to spend on a Census.

Census Administrative Records

One way Census plans to save money in the 2020 Census is by using other data the government collect—termed administrative records—to ease the process of contacting people who do not respond to the initial mailing. For example, if a dataset shows that a dwelling is unoccupied, the bureau could avoid sending an enumerator to that address. Some of the administrative records Census plans to use are from the IRS.

Question: Are records from the IRS really needed?

Answer: Yes. As evidenced by decades of use in population estimates and the Economic Census, data from the Internal Revenue Service (IRS) provide high quality, national coverage, relevant information for Census Bureau measurement needs. For the 2020 Census, IRS data provide hundreds of millions of timely records supporting efforts to understand whether housing units are occupied and to improve enumeration operations. For the American Community Survey (ACS), IRS has data on income concepts similar to those asked on the questionnaire.

The Census Bureau receives federal tax data based on 26 U.S.C. §6103j(A), which specifically allows the Census Bureau to use tax data for structuring censuses and related statistical activities. Also Section 6, Title 13 states "to the maximum extent possible and consistent with the kind, timeliness, quality and scope of the statistics required, the Secretary shall acquire and use

information available from any source... instead of conducting direct inquiries." We owe it to the American people to maximize the utility of this information they have already provided to the Federal government rather than asking for it again.

Question B: What steps have you taken to inform the public about this plan?

Answer B: The Census Bureau describes its acquisition and handling of administrative records from agencies including the IRS in our System of Records Notices, pursuant to the Privacy Act. These notices are posted on the Census Bureau website, having passed public inspection in the Federal Register. The Census Bureau describes its person level data linkage activities on its website, and describes its work using IRS and other administrative records in public events including Program Management Reviews and advisory committee meetings.

The Census Bureau routinely reaches out to privacy advocacy groups and incorporates them into the work process in various ways. For example, advocates are invited to and attend various Census Advisory Committees where they provide feedback on the development of statistical programs and products and new initiatives. The Census Bureau's National Advisory Committee includes two privacy experts, Kirsten Martin, assistant professor at the George Washington University, and Barry Steinhardt, the first chairperson of the Friends of Privacy and a trustee and senior advisor to Privacy International. The National Advisory Committee has addressed multiple facets of 2020 Census planning, including a working group dedicated to studying the use of administrative records. Census Bureau staff engages with the privacy community, including briefings with the Future of Privacy Forum and the Privacy Working Group. These discussions included overviews of the agency's authority to obtain external data, our acquisition of federal and state program data, and the procurement and use of third party data sources. The experts consulted affirmed the Census Bureau's plans for statistical use of administrative records data and welcomed continued dialogue and updates.

Question C: What privacy protections do you have in place?

Answer C: When the Census Bureau receives data from any other organization, this information is protected. All information provided to the Census Bureau is used only for statistical purposes, held strictly confidential, and protected by rigorous physical, procedural, and information security protocols that meet Census Bureau, IRS, and Federal Information Security Management Act (FISMA) standards. In addition to statutory or policy requirements from the data provider, which are spelled out through interagency agreements, the Census Bureau also protects administrative records under 13 U.S.C. § 9, which stringently protects the confidentiality of individuals and limits the use of information solely for statistical purposes. By law, the Census Bureau cannot publicly release information that could identify an individual. These laws carry strict penalties. The penalty for unlawful disclosure of information protected by Title 13 of the U.S.C. is a fine of up to \$250,000 or imprisonment of up to five years, or both. To implement these protections, the Census Bureau has developed strong data stewardship policies and practices to ensure accountability. In addition, the IRS conducts Safeguard Reviews to ensure that that we comply with their data protection standards on a regular basis.

Question D: How do your privacy protections compare to those of the IRS?

Answer D: Tax information is protected under Title 26 of the U.S. Code (Tax Code). When the Census Bureau receives tax information from the IRS, it protects these data according to the Tax Code and all of the applicable tax regulations, as well as other applicable federal statutes and regulations, such as FISMA.

In addition, the Census Bureau protects tax data under its own law, Section 9 of Title 13 of the U.S. Code. Section 9 applies strict use limitations, limiting the use of data for statistical purposes, which means the data cannot be used for civil, administrative, or law enforcement purposes. In addition, only sworn individuals may access data at the Census Bureau. The penalty for unlawful disclosure of information protected by Title 13 of the U.S. Code is a fine of up to \$250,000 or imprisonment of up to five years, or both. The Census Bureau also safeguards tax information and other administrative data by routinely restricting access to sensitive personally identifiable information (PII). The Census Bureau replaces sensitive information, including names and Social Security Numbers, it acquires from other federal and state agencies with unique codes in order to facilitate data linkages. Only limited staff have access to files containing sensitive information for the purposes of processing the original files or conducting specific research projects, such as evaluating the matching programs.

Question E: Does Census need additional legislative authority in order to access the administrative records it seeks?

Answer E: The Census Bureau currently has authority to use many sets of government records for statistical purposes. To maximize cost savings and maintain data quality for the 2020 Census, we would like access to additional record sets, such as components of the National Directory of New Hires. This source, in addition to increasing the usefulness of Census Bureau data products for informing policy and program decisions, is critical to the estimated \$1.2 million in cost savings that the Census Bureau believes it can achieve through the use of information people have already provided to the government. The NDNH supplies information on all job holders, including the newly hired, which would confirm and supplement information on workers received in tax data. The NDNH also includes information on persons receiving unemployment benefits, improving our coverage of this hard to reach group. Failing to receive access to the NDNH data in time to test and implement for the decennial census would jeopardize the power and cost savings potential of the initiative to expand use of administrative records for the 2020 Census.

Additional records from the states like SNAP (Supplemental Nutrition Assistance Program) and the Women, Infants, and Children (WIC) program will help us to expand coverage for children, low-income adults, and other individuals disconnected from the labor market. While we do not require additional legislative authority to obtain the SNAP and WIC records, the states lack the incentive and technical capacity to share data with the Census Bureau. We are also working to acquire the Parent-Child SSN Link (KIDLINK) database that is compiled by the Social Security Administration and maintained at the IRS. Access to this database will require changes to regulations governing data sharing between IRS and the Census Bureau.

The Census Bureau is currently evaluating federal records sources with the intention of negotiating agreements, under existing legal authority, to access data. These agencies include the

Departments of Defense, Homeland Security, and Veterans Affairs, as well as expanding access to Internal Revenue Service data. Specifically, the Census Bureau is exploring the potential uses of data from these programs:

Data AND OWNER/PROVIDER	Description AND INTENT
I-9 EMPLOYMENT VERIFICATION FORM Department of Homeland Security	I-9s are used to verify the identity and employment authorization for all persons hired. The Census Bureau will explore use of these data to corroborate information in other files for the 2020 Census.
J-1 and J-2 Visas Exchange Visitor Program Department of Homeland Security	J-1 data contain information for persons in the U.S. for cultural exchange and training. J-2 data contain information for spouses and dependents of J-1 visa holders. The Census Bureau will explore use of these data to improve person coverage for the 2020 Census and to develop statistical products for this group.
VETERANS AFFAIRS BENEFITS PROGRAMS Department of Veterans Affairs	Information from disability compensation, disability pension, education, home loan guarantee, and vocational rehabilitation and employment programs. The Census Bureau will explore use of these data to improve data quality and reduce respondent concerns in the ACS, improve coverage for the 2020 Census, and to enhance other current demographic and economic surveys.
Defense Enrollment Eligibility Reporting System (DEERS) Department of Defense, Defense Manpower Data Center	DEERS contains information for current and former members of the armed forces. The Census Bureau will explore use of these data to improve data quality and reduce respondent concerns in the ACS, improve coverage for the 2020 Census, and to enhance other current demographic and economic surveys.
Parent-child ssn link (aka, kidlink) Internal Revenue Service	This file links parent and child SSNs for children born after 1998 in U.S. hospitals. The Census Bureau will explore use of these data for person linkage and validation operations and to improve intergenerational linkage keys to study economic mobility and poverty using decennial and current surveys.

Question F: Have you worked with the authorizing committee on this topic?

Answer F: The Census Bureau regularly consults with its authorizing committee regarding preparation for the 2020 Census and conducts open public meetings, such as the quarterly Program Management Review meetings, which congressional staff and other oversight can attend in person or via webcast.

Internet Response

One of the ways Census plans to save money in the 2020 count is by allowing the use of the Internet for response. With 140 million households estimated to participate in the survey, the number of visitors will be huge. The ObamaCare website melted down after receiving just 250,000 visitors.

Question: What steps are you taking to prevent something like this from happening to the Census website?

Answer: Initial work on the Internet Self Response capability required to support the 2020 Census is well underway. Early efforts have centered on the Centurion application--a Census developed and managed, web-based framework for the design and delivery of surveys over the Internet. This application is the established, primary vehicle for Internet data collection for an array of existing surveys conducted by the Census Bureau, including the American Community Survey (ACS), demographic program surveys, and economic surveys. The 2020 Census tests have successfully relied upon Centurion as the vehicle for Internet self-response. Additional testing during 2016 will provide data to support the continued analysis of the application and the feasibility of its use for the 2020 Census.

Recognizing that the 2015 Census Tests are not indicative of the scale required to support the 2020 Census, we have begun to conduct extensive performance testing on the Centurion application. The current version of the Centurion application, as well as two variant versions of the Centurion application focused on the 2020 Census, are undergoing regular, incremental performance tests concentrating on scalability, concurrent user load, and adaptability to a cloud-type environment. Tests have been conducted on the current and variant applications to ensure the applications can "autoscale" or automatically increase the number of instances during demand spikes to maintain performance and decrease capacity during lulls. These tests were not conducted to ensure the applications could sustain massive load, but rather to confirm that the applications could begin with a smaller capacity 'footprint' and then elastically expand and contract as user loads "ramped up". Both the current and alternate applications successfully passed the scalability tests thus far. Further testing will continue in the future as we move to other environments.

To test the applications' ability to adapt to a cloud-type environment, the current and alternate Centurion applications have been introduced into a cloud environment successfully, testing the submission of Internet responses for self-response operations and the scalability of the applications. Further testing operations are planned in the near future. Regular concurrent user load testing will be conducted to ensure the Internet response application can meet demand. Early performance load testing has focused on obtaining baseline data for the current and variant Centurion applications. Additionally, these tests are being performed in multiple environments, including cloud-type environments and our Bowie Computer Center test environments. Tests are being run by a third-party contractor in collaboration with the Census Bureau's Information Technology Directorate for monitoring purposes, including IT security, infrastructure,

telecommunications, and Internet teams. In the last month alone, three performance test operations were conducted, with an additional three tests scheduled for the upcoming month to focus on expanded infrastructure and optimization techniques.

While the Centurion tool has performed well to date, the Census Bureau has also performed a preliminary Analysis of Alternatives (AoA) to assist in making a sound decision about the solution ultimately selected for the 2020 Census. This AoA will allow further exploration of the viability of internal tools and will provide insight into industry best practices and ideas, both informing the selection of the Internet self response solution for the 2020 Census.

Finally, given the rising prominence of the Cloud as a mechanism for providing the type of support required by an operation the scale of a Census, the Census Bureau is undertaking a coordinated and judicious exploration of the use of the Cloud to provide support for the 2020 Census. Testing will allow us to determine processing thresholds and bottlenecks, and establish system performance baselines in a Cloud environment and to continue the performance testing outlined above. Based upon the results of this testing, the Census Bureau will then conduct an acquisition to support the 2016 Census Test, the results of which will inform the larger Cloud strategy for the 2020 Census.

Question B: What steps are you taking to ensure this site will be secure?

Answer B: The Centurion application, a Census- developed and -managed, web-based framework for the design and delivery of surveys over the Internet, has undergone certification and accreditation testing and has received an Authority to Operate (ATO) from the Census Bureau's Office of Information Security. Centurion is reviewed on a regular basis in accordance with the Census Bureau's continuous monitoring program, which aligns with the IT Security Program's Risk Management Framework. Under the continuous monitoring program, Centurion and the underlying infrastructure are scanned for both compliance and vulnerabilities on a monthly basis. Remediations of any findings are identified and formally tracked through the Census Bureau Plan of Action and Milestone (POA&M) process. In addition, the Office of Information Security's independent assessment team issues a six-month schedule of the security controls that will be assessed manually. The current assessment schedule runs from January 2015 to the end of June 2015 at which time a new six-month schedule is developed based on risk. As with compliance and vulnerability findings, anything noted during the manual assessments is documented and tracked through the POA&M process.

Additionally, we regularly conduct security and penetration testing on the Centurion application. Penetration tests are run on a regular basis. There have been four tests completed in the past 6 months. These tests have been run by an independent contractor on specific components. In addition, we are adding additional security resources to enable us to expand our penetration testing schedule. Furthermore, IT security is a key participant in the Cloud effort and ensures that that Federal, Department of Commerce, and Census Bureau security requirements, including FedRAMP certifications, are met.

Patent and Trademark Office – Telework and Nepotism

Last year several very disturbing management practices at the Patent and Trademark Office came to light including nepotism in hiring at the Trademark Office and abuse of telework programs by patent examiners and paralegals. The timely processing of patent and trademark applications is important to our nation's economy, and the PTO's application backlogs have been significant for many years. The idea that PTO has patent backlogs in excess of 500,000 applications and yet employees are being paid for time they haven't worked is very troubling. PTO has promised to address these abuses and give their supervisors better tools to manage their employees.

Question: What are you doing to monitor PTO efforts to improve their time and attendance reporting?

Answer: The Department and the USPTO have worked together closely on these issues. For example, among other things, DOC assisted the USPTO in hiring the National Academy of Public Administration (NAPA) to review USPTO's telework policies and internal controls. This review is being led by a five-member Panel of expert Academy Fellows with support from a professional study team. The Panel and study team are assessing program controls and evaluating management control activities associated with USPTO teleworkers, approval to work overtime and compensatory time, administration of leave, documented telework program requirements to notify of telework and work schedules, and use of USPTO-designated information technology and collaboration tools. The Panel and study team are also examining the USPTO Telework Program's impact on employee productivity, recruitment and retention, continuity of operations, and management and operating costs. This review will inform DOC and the USPTO of further opportunities for further improvement and best practices in this area.

In addition, the USPTO has formed teams from across the Agency to work together to explore more effective methods for the early intervention and prevention of telework-related and time-and-attendance-related problems, as well as the enforcement of telework guidelines when problems occur. Among other things, the USPTO has revised guidance documents and conducted new trainings for managers and employees regarding the telework programs. Similarly, DOC has developed and launched a new Department-wide online training course for time and attendance reporting. This course addresses manager and employee responsibilities, as well as reporting requirements.

Question B: What are you doing to ensure that all Commerce employees who telework are working appropriately?

Answer B: Consistent with the Telework Enhancement Act of 2010, DOC encourages all eligible employees to telework, which helps attract and retain talent, promotes workplace efficiency, and increases employee performance and morale. We recognize that to fully deliver these benefits, telework requires appropriate oversight. The new telework policy DOC adopted last fall promotes telework while instituting processes to ensure that teleworking employees work and are supervised appropriately. As part of the new policy, DOC requires employees to enter into a written telework agreement, to complete mandatory training, and to discuss work hours, expectations, and methods of communication with their supervisor. Managers who

approve telework agreements are also required to complete training, and are expected to regularly communicate with teleworking employees about their assignments and hold them accountable for meeting deliverables, just as they do with all employees.

Question C: How do you plan to discipline employees found to abuse the telework programs?

Answer C: DOC takes compliance with its telework and time-and-attendance requirements seriously. The Department's employee relations staff works with the manager of an employee found to abuse telework to determine the extent of the abuse and the appropriate discipline, ranging from reprimand to removal. Among other things, consistent with the Telework Enhancement Act of 2010, DOC's telework policy provides that employees are ineligible to telework if they do not comply with the terms of their written telework agreement.

Bureau of Industry and Security

The Bureau of Industry and Security regulates the export of "dual use" technologies and enforces export control laws. It is critically important that dual use technologies do not fall into the hands of terrorists or weapons proliferators. As part of the Administration's Export Control Reform, export licensing for many items is moving from the Department of State to the Bureau of Industry and Security. The budget request proposes a \$13 million or 12% increase most of which is for export enforcement such as additional export control officers located overseas, an export enforcement coordination center, and additional special agents and analysts.

Question: Why is the Administration moving some export licensing from the Department of State to Commerce?

Answer: In August 2009, the President directed a broad-based interagency review of the U.S. export control system, with the goal of strengthening national security and increasing the competitiveness of key U.S. manufacturing and technology sectors by focusing on current threats, as well as adapting to the changing economic and technological landscape. This review determined that the current export control system is overly complicated, contains too many redundancies, and diminishes our ability to focus our efforts on the most critical national security priorities.

As a result, the Administration launched the Export Control Reform (ECR) Initiative, which is fundamentally reforming the U.S. export control system. The ECR Initiative is designed to enhance U.S. national security and strengthen the United States' ability to counter threats such as the proliferation of weapons of mass destruction.

By moving less sensitive items (primarily parts and components) from the less flexible U.S. Munitions List (USML) administered by the Department of State to the more flexible Commerce Control List (CCL) administered by the Department of Commerce's Bureau of Industry and Security (BIS), ECR will enable increased interoperability with allied countries, strengthen the

U.S. industrial base by reducing incentives for foreign manufacturers to design out and avoid using U.S. parts and components, and allow the U.S. Government to focus resources on the most serious national security and proliferation concerns.

Question B: Why is such a significant funding increase necessary?

Answer B: The increase in authorization will allow BIS to have sufficient enforcement resources as well as sufficient resources to properly and timely process the license applications and related matters for the items that have or will become subject to the Commerce Department's jurisdiction as part of the ECR Initiative.

BIS's workload is increasing dramatically as a result of ECR. The number of export licenses that BIS processes annually has already increased from 24,000 in FY 2013 to 31,000 in FY 2014, with the volume anticipated to grow to about 50,000-55,000 licenses by the end of FY 2016, a 154 percent increase since 2010.

To ensure U.S. national security and foreign policy interests remain protected even as the volume of trade in items for which BIS is responsible significantly increases, the bureau needs substantially more resources to ensure that the United States maintains its military superiority and that it is able to effectively police the export of the tens of thousands of military items transferred to BIS's jurisdiction from the Department of State.

We thank Congress for the support it has given us to advance our national security mission. In light of the increasing national security challenges that our Nation continues to face, we will continue to work together in an effort to increase funding levels which will enable BIS to fully implement ECR, to better incorporate the management of the increasing licensing/STA workload, and to strengthen our enforcement capabilities. BIS' FY 2016 funding request of \$115.1 million provides additional resources as a critical "next step" insuring that our enforcement and investigative capabilities keep up with the export communities increasing demand reflected in our licensing application workload. Significant progress in ECR has been achieved on licensing and outreach to the export community. Without full funding of the FY 2016 President's budget the key risk is that our intelligence, analytical, outreach, and enforcement resources will not keep pace even as our licensing workload nearly doubles.

BIS' FY 2016 request will allow the Bureau to continue to build upon and support the advances made by ECR efforts while also strengthening BIS's operations to address numerous national security challenges as it counters new threats. The FY 2016 President's budget request of \$115.1 million, an increase of \$12.6 million over the FY 2015 enacted level of \$102.5 million, supports our commitment to protect our nation's security.

The FY 2016 request begins with an increase of \$3.77 million associated with our adjustments-to-base (ATBs), which includes funding for Federal pay as well as inflationary increases. Without this funding, BIS risks the erosion of its base in order to maintain the same level of services as it has received in prior years. To meet the ECR requirements, BIS anticipates significant increases in licensing applications and associated investigative and outreach activities. To date, BIS has implemented process improvements and advanced technology to

manage the increased workload; but, it will not be able to execute future increases effectively without eliminating current program activities being funded in the base.

To ensure that U.S. exporters' applications receive a thorough yet prompt review, BIS also requests \$0.465 million for additional resources to process the high volume of additional license applications and related actions. In particular, additional engineering capability and technical expertise are sorely needed to build up our already very lean bench of experts and to increase BIS's overall capacity to adequately assist in licensing and compliance activities.

In response to rising workloads and emerging threats, the BIS FY 2016 President's Budget requests funding (\$8.3 million) for the expansion of enforcement resources (e.g., new Export Control Officers, Information Triage Unit analysts, Special Agents). This enforcement capability must keep up with, and be able to support, the increase in enforcement responsibilities resulting from the reform effort. The Government Accountability Office (GAO) and the House Armed Services Committee (among others) have taken note of this need.

BIS's 110 Special Agents are the *only* federal law enforcement officials solely dedicated to export enforcement.

BIS workload for its Special Agents is approximately 12 cases per agent when an agent should only be expected to carry 5-6 open cases. Top cases—i.e., those that focus on BIS's top three priorities, namely WMD proliferation, terrorism support, and unauthorized military end use - have taken an average of 1,600 days, or 4.4 years, to complete. Funding of the FY 2016 request will enable BIS to reduce its per agent case workload to a more manageable number of cases and ensure that new leads are pursued.

Trends appear to be more toward complex cases that will drive up the time to run a case. As the complexity of cases increase and without additional resources, we will also not be able to pursue new leads that may develop into significant investigations of export control violations.

Weather Satellites

NOAA is currently developing two weather satellite systems -- the Joint Polar Satellite System and the Geostationary Operational Environmental Satellite -- to replace existing weather satellites. The fiscal year 2015 appropriation included \$1.9 billion, the full request, to continue these efforts. The fiscal year 2016 request includes about \$1.7 billion for these two satellite programs, reflecting planned reductions as milestones toward launch are achieved. NOAA states that satellites provide, on average, about 95% of the data assimilated into the National Weather Service numerical weather prediction models. Of this, more than 80 percent are from polar-orbiting satellites.

Question: Can you provide the Committee with an update on efforts to mitigate any potential gaps in weather satellite systems?

Answer: NOAA is implementing a multi-pronged approach to mitigate the impact of and reduce the potential for any gaps in the polar-orbit.

The first component of the approach is to ensure that our satellite acquisition activities for JPSS-1 and JPSS-2 remain on schedule, within budget, and are launched on time. The JPSS-1 development is on track for a launch commitment date no later than the second quarter of FY 2017. The JPSS Program continues to maintain the JPSS-2 launch commitment date of no later than the first quarter of FY 2022.

The second part of the approach is to initiate the Polar Follow-on (PFO), which will achieve robustness in the afternoon polar weather constellation as early as FY 2023. The PFO funds the following activities:

- Initiate development of PFO/JPSS-3 to meet a launch readiness date in the second quarter of FY 2024, and PFO/JPSS-4 development to meet a launch readiness date in the third quarter of FY 2026.
- Provide the option to accelerate PFO/JPSS-3 as a contingency mission with critical sounders Advanced Technology Microwave Sounder (ATMS) and Cross-track Infrared Sounder (CrIS) only.
- Invest in development of an advanced technology Earth Observing Nanosatellite-Microwave (EON-MW).

The FY 2016 funding request for PFO is essential to minimize the risk of a loss of continuity of polar observations and to meet the PFO launch readiness dates that are designed to minimize the potential for a gap in polar-orbiting satellite coverage.

The third piece of the approach is to complete the activities funded by the Sandy Supplemental appropriation. The 17 projects selected for implementation were deemed the most important to mitigate the impact from the potential loss of polar orbiting data. NOAA is working to execute these projects to ensure NOAA's weather forecasting capabilities should a gap occur.

The fourth part of the approach is to exploit alternate data sources that would mitigate the impact of a potential gap in polar-orbiting data. The FY 2016 Budget request continues development of the ground data reception and data processing segments for the COSMIC-2 mission. Taiwan and the Air Force are on target for the FY 2016 launch of COSMIC-2a which will fly in the equatorial constellation. Additionally, the FY 2016 Budget request provides funds to initiate procurement of six radio occultation sensors for COSMIC-2b, which is planned to fly in the polar constellation in FY 2019. While GNSS RO data is not a replacement for the type and quality of data that the JPSS satellites provide, the launch of the COSMIC-2a and 2b helps to mitigate the impacts of a potential loss of critical sounder instruments from NOAA's polar observing system.

Question B: As part of the polar weather data gap mitigation effort, NOAA is requesting funds to launch another set of radio occultation satellites. Why should NOAA build and launch these sensors instead of buying the data from the private sector?

Answer B: NOAA has a long history of purchasing commercial data to fulfill its operational requirements. NOAA currently has the need for radio occultation data for operational numerical weather prediction. At this time, there are no commercial sources of radio occultation data available for purchase. If these commercial data were available, NOAA would evaluate the utility of the data to meet its operational requirements. In the absence of available commercial alternatives, the COSMIC-2 program provides the lowest programmatic risk approach to obtaining global radio occultation data.

NOAA continues to have discussions with the aerospace industry as it matures and develops new and additional data streams, including radio occultation missions. NOAA will continue to evaluate the systems of commercial providers to make a determination to purchase data that meets NOAA's operational requirements, pursuant to the Federal Acquisition Regulations, and subject to the availability of appropriated funds for commercial data buys.

Background

NASA is an expert at building and launching satellites.

Question: Why should Commerce be involved in building satellites? Shouldn't we just give NASA the funds to build you what you need?

Answer: The Department of Commerce and NOAA firmly believe that the current arrangement is the best means to effectively meet national priorities and achieve the respective missions of NOAA and NASA. Appropriations provided to Commerce/NOAA allow it to fund and leverage NASA's vast expertise to develop mission-specific satellite systems while allowing NOAA to remain tightly coupled to the requirements process and ensure these systems meet the stringent operational needs of NOAA's 24x7 weather forecasting mission. NASA can use its expertise in the areas that NASA is uniquely qualified (such as space exploration mission, cutting edge research and development activities, human spaceflight, and aeronautics research), while NOAA can use its expertise to ensure that national requirements are met with the acquisition and development of the most critical operational weather systems.

National Ocean Policy

Every year, I am sure you are aware that there is lively Floor debate on our bill with respect to the National Ocean Policy. I hope that my friends on the authorizing Committees are able to work with you and others in the Executive Branch to resolve concerns about this initiative.

Question: Are you requesting any funds in fiscal year 2016 to work on, develop, or otherwise implement in any way the recommendations, plans or other activities included in the National Ocean Policy implementation plan or to implement Executive Order 13547?

Answer: None of the funds requested are explicitly devoted to carrying out the President's National Ocean Policy. NOAA, like other National Ocean Council Agencies, has a number of existing programs and resources committed to ocean related management activities, missions, and objectives under existing authorizations or other legislation. The National Ocean Policy does not alter, replace, or extend these existing funding commitments or directives. Rather it helps to better focus and leverage these existing, limited resources and allows for more efficient use of taxpayer dollars by improving coordination and collaboration, and identifying clear priorities and associated actions.

Question B: Are any NOAA employees working on this effort now, in fiscal year 2015? If so, would you please identify for the record the number of employees working on National Ocean Policy activities?

Answer B: There are no NOAA employees explicitly devoted to carrying out the President's National Ocean Policy. NOAA's current employees, like other National Ocean Council Agencies, support existing programs committed to ocean related management activities, missions, and objectives. As noted above, the National Ocean Policy helps to better focus and leverage these existing resources by improving coordination and collaboration and identifying clear priorities and associated actions.

Inspector General Access to Information

Last week we heard from Inspector General Zinser that in some instances he has trouble getting access to information from the Department. Ideally, a department secretary and the Inspector General should work together cooperatively. You should use the IG's expertise to help improve the operations of the agency. When you have concerns about a program you should reach out to the IG for help to improve the operations of the agency. For high-risk projects, you should consider having the IG's office embedded with the program from the start.

Question: Do you believe that the Inspector General should have access to all appropriate information?

Answer: We take compliance and oversight very seriously, and appreciate the critical role that Offices of the Inspector General play in improving management and preventing waste and abuse in the Government. We are fully committed to working cooperatively with the Inspector General on his oversight work and, as the IG Act requires, providing access to all appropriate information the Inspector General needs to do his job. As Mr. Zinser acknowledged in his testimony before this Committee, when issues arose regarding the Inspector General Office's access to monthly Program Management Council meetings for the weather satellite program, we ensured that Mr. Zinser received the access he needed. We will continue to take such actions as necessary to ensure that David Smith, the Acting Inspector General, has the legally required access to information he needs to conduct his oversight work.

Question B: How will you ensure that everyone in the Department knows that they should not deny the IG information?

Answer B: The Department has established policies that require employees to cooperate with the Office of the Inspector General during audits and investigations, and provide the Inspector General access to materials that relate to Departmental programs and operations. Specifically, Department Administrative Order (DAO) 213-3 provides that employees are to cooperate fully with the OIG and to provide access to information that relates to an OIG review. DAO 207-10 further provides that Department officers and employees shall not withhold appropriate information from the OIG.

In addition, new employees are advised of their responsibility to cooperate with OIG audits and investigations during new hire orientation, and the Department makes additional training and on-line materials available to employees that describe how to appropriately respond to OIG audits and investigations. Notably, the Department's Office of the General Counsel recently has established an Oversight Division, which is working with Department leadership and employees to ensure that they understand their responsibilities to the OIG under the IG Act and Department Orders.

Question C: Should there be a punishment for staff that inappropriately withhold access to information from the IG?

Answer C: Inappropriately withholding information from the OIG may result in disciplinary action against an employee. For example, Department Administrative Order 207-10 advises Department officers and employees that refusing to answer questions or otherwise cooperate with an OIG investigation may result in discipline action up to and including removal.

Ocean Survey Vessel

The budget request proposes spending \$147 million to construct an ocean survey vessel. I understand that the NOAA fleet is aging.

Question: However, instead of purchasing a new vessel, have you looked into seeing if the private sector could provide this service more efficiently?

Answer: NOAA currently relies on chartering to support many missions. Days-at-sea (DAS) is the primary operating metric unit used for planning at-sea missions. Over the past five years, on average, DAS were allocated: approximately 2,900 DAS conducted within the NOAA Fleet and approximately 2,200 DAS performed on various charter vessels (including charter vessels under 130ft in length).

Use of charter vessels in any given year is driven by two factors: 1) compatibility of the required mission with the availability of an appropriate charter vessel; and 2) funding. The NOAA Fleet and charter DAS totaled approximately 5,100 over the past five years. Meeting NOAA's at sea data collection needs requires use of both NOAA and charter vessels.

Several factors are considered before assigning a mission to a platform.

- A charter vessel is most efficient when:
 - The Scientific party is no more than 4-6 people
 - The cruise is of limited duration (less than ~20 DAS)
 - Specialized equipment is not needed or alternatively, if the vessel simply needs to fish with one type of gear
 - The cruise either is not collecting data that is part of a time-series or if it is, there is a mechanism for calibrating survey results between years
- A NOAA vessel is most efficient when:
 - There are multiple scientific missions conducted during the cruise
 - The scientific party is large (10-14 individuals)
 - The cruise is long (over ~20 DAS)
 - Specialized equipment is needed, particularly when oceanographic sampling or dealing with novel sampling conditions (e.g., deep water operations, towing passive acoustic listening arrays, or deploying autonomous or remotely operated vehicles)
 - The cruise results are part of a time-series survey

Constraints in the charter industry – including compatibility with NOAA science missions and availability of charter assets – are currently a limiting factor to more chartering by NOAA. Most NOAA missions require additional ancillary science support - while this support is available on all NOAA vessels it is not typically a part of commercial or private charter operations. In addition, there are operating efficiencies associated with maximizing the operational capacity of the NOAA Fleet. The FY16 President's Budget provides for a utilization rate of 86%.

Within the federal family, NOAA welcomes and values partnerships. In FY 2014, NOAA chartered 343 DAS on National Science Foundation (NSF)/University-National Oceanographic Laboratory System (UNOLS) Fleet. NOAA utilizes NSF-UNOLS vessels in instances where there is alignment between NOAA's research needs and UNOLS availability. There is alignment when a vessel has time and space available in the right location to accomplish NOAA's research. Due to the requirements for certain research to be conducted in specific locations and seasons, the UNOLS fleet cannot meet all of NOAA's seasonal requirements. Additionally, NOAA uses its own fleet or other charters in cases where the UNOLS platform does not match the research required (e.g. trawling capabilities are a necessity for fish stock assessments).

Conducting all of NOAA's at-sea missions via charter vessels poses many challenges related to cost effectiveness, timing/availability, mission capacity, and emerging technologies. These factors must be weighed in determining the appropriate balance of public and private vessels in meeting the nation's ocean science requirements. More complex cruises require more complex ships. For example, the trend worldwide is for fishery oceanography cruises to bundle multiple observing systems during a cruise to provide complete ecosystem level information. Such cruises require an acoustically quiet ship with multi-beam hydroacoustic gear (e.g., ME70/80 and EK500 systems) to record fish and zooplankton biomass; a capability to deploy trawl nets, plankton tows and instrument drops (all of which require separate winches); multiple sighting

stations for marine mammal and sea bird observations; quarters for up to 14 scientists so that surveys can be conducted around the clock; and endurance of a month or more. The 60 day spring and fall groundfish trawl surveys in the Mid-Atlantic and New England and the 60 day Sardine-Hake "SAKE" Cruise off the West Coast – both conducted by the NOAA fleet - are good examples of cost-effective, multipurpose surveys. At this time, no commercial charters are available to meet these varied and complex scientific requirements.

Complete reliance on fleet support through charters would also impede NOAA's ability to respond to significant events and national emergencies. NOAA, as the nation's ocean agency, is expected to respond to extreme events when its products and services are vital to the federal response. The multi-mission capabilities of the NOAA Fleet can respond to severe weather events and environmental catastrophes (e.g. Deepwater Horizon) to assess impacts and determine when ports can be opened without risk to public safety and commerce. Maintaining NOAA's ability to react quickly to national emergencies, and maintain technical and operational expertise via its multi-mission/platform fleet yields economic benefits to the nation.

FirstNet

\$7 billion of mandatory funding is available to establish a nationwide interoperable public safety communications network.

Question: Can you describe how FirstNet is working to ensure that this money is spent appropriately and can meet the needs of our nation's first responders?

Answer: FirstNet's mission is to ensure that a nationwide, interoperable, wireless broadband network is built for the public safety community. The deployment, on-going operations, and sustainability of the nationwide public safety broadband network (NPSBN) will require significant financial resources and capabilities. FirstNet has up to \$7 billion of federal funds to invest in the network, which alone will be insufficient. In order to build the network and achieve financial sustainability as required under the Act, FirstNet will need to leverage its other available assets, funding from user fees, and agreements with third parties for secondary use of its excess network capacity. Additionally, FirstNet is looking to leverage existing infrastructure to realize cost synergies with potential partner(s). FirstNet recently released a Special Notice with draft Request for Proposal documents.

In addition to developing a business model that helps to ensure FirstNet leverages its funding and other resources in the most responsible and effective manner, FirstNet has placed a priority on public safety input at every stage of its consultation and outreach efforts, so that its planned network truly meets first responders needs and objectives. FirstNet's efforts to interact with local, state, tribal, and Federal stakeholders are a centerpiece of the FirstNet mission. In FY 2014, FirstNet addressed over 20,000 stakeholders at conferences, meetings, and speaking events throughout the country. In FY 2015, FirstNet has connected with over 25,000 public safety and private sector stakeholders at nearly 200 outreach and consultation engagements.

FirstNet continues to collaborate closely with the states. The objective of FirstNet's consultation process is to develop detailed State plans that address the unique communications needs of each

state's public safety entities. As prescribed in the Middle Class Tax Relief and Job Creation Act of 2012, these individual plans will inform and empower each state's choice to have FirstNet deploy the radio access network (RAN) within the state's borders or to assume the financial and operational responsibility to build, operate, and maintain its own RAN that integrates with the remainder of the FirstNet network.

For more details on FirstNet's consultation and outreach efforts, I point you to FirstNet's testimony delivered on June 16, 2015, before the House Energy and Commerce Committee.

Question B: How will FirstNet ensure that all of the various State and local agencies will agree on using the system?

Answer B: FirstNet intends to earn the business of first responders by providing a product that meets the unique needs of public safety while being competitive in cost to the commercial services available to public safety today.

State consultation is not only required by statute but of critical importance to the ultimate success of FirstNet. FirstNet's state, local, and tribal planning consultation process, coordinated through the governor-designated state single points of contact (SPOCs), ensures that FirstNet obtains key information from the public safety community and leadership of all 56 states and territories. In addition, because FirstNet anticipates that federal agencies with public safety missions also will be important customers for its services, FirstNet has engaged in consultation and outreach at the federal level as it develops its implementation plan. The objective of FirstNet's consultation efforts, and its outreach to industry groups, is to ensure that FirstNet's planning for the nationwide network addresses the unique communications needs of public safety entities at every level of government.

Question C: Does FirstNet have a management structure in place to accomplish such a large endeavor?

Answer C: FirstNet's FY 2014 annual report to Congress outlines its organization and management structure.[1] Over the past three years, FirstNet has made tremendous progress in establishing and staffing its organization and advancing its mission. The FirstNet Board is composed of 15 members who provide strategic direction to FirstNet's management. These Board members are dedicated public servants with deep experience in public safety or with the financial and technical expertise needed to deploy a wireless network. FirstNet has accomplished a considerable amount of work in just a short period of time, including developing a strategic roadmap, developing a business model approach and assumptions, initiating state consultation, engaging with the federal user community, obtaining industry and stakeholder feedback, developing draft request for proposal documents, establishing its headquarters in Reston, Virginia and the Boulder, Colorado technical office, engaging with international standards bodies on public safety requirements, and working with early public safety Broadband Technology Opportunities Program (BTOP) projects on key learning conditions.

Challenges still remain, however, in attracting and retaining top talent for a project of this size and complexity. FirstNet is competing with industry to recruit top talent in a highly competitive

environment, and the federal hiring system puts FirstNet at a disadvantage. The Department actively supports FirstNet in its human resources functions and is working to streamline and expedite federal processes. Every administrative solution is being explored to provide FirstNet senior management with the resources needed to deploy the nationwide network.

For example, FirstNet continues to seek limited direct hiring authority from the Office of Personnel Management in an attempt to speed up the hiring of technical experts and outreach staff. Both are key pillars of the organization and the network cannot be deployed without dedicated staff in each division. FirstNet also recently adopted the Commerce Alternative Personnel System (CAPS), which allows FirstNet additional flexibility in making offers to qualified personnel and will add to the entrepreneurial culture that the organization is developing.

Last year, FirstNet launched a search for a permanent Executive Director. The FirstNet Board is currently interviewing several qualified candidates and expects to announce its selection for the position shortly.

[1] http://www.firstnet.gov/sites/default/files/Annual%20Report_FY2014_FINAL_3_3_15.pdf

National Institute of Standards and Technology

NIST's Core Laboratory Mission

NIST's budget requests a \$9 million increase for spectrum efficiency work. This would do things such as develop higher performance wireless transmitters and receivers as well as to develop test and measurement techniques for higher frequency spectrum.

Question: Companies are spending many billions of dollars at spectrum auctions. Isn't it in auction winners' best interest to make their use of spectrum as efficient as possible?

Answer: Yes, it is in the wireless carriers' best interest to efficiently use their spectrum allocation. Currently, carriers have sole use of licensed bands and can optimize efficiency based on equipment selection and operational practices. However, some of the 500 MHz of spectrum identified for future broadband use will not be occupied by a single carrier. Instead, some of these frequency bands will be shared by both Federal and commercial users, who will operate very different types of wireless systems in the same frequency band. In these cases, maximizing spectrum efficiency requires a multi-party optimization in which the various wireless systems coexist in the same frequency band without undue interference that could either significantly degrade the performance of commercial systems or compromise the operation of

mission-critical Federal systems. This new sharing regime will benefit from new wireless coexistence metrics and measurement methods that assist multi-party users in their efforts to maximize spectrum efficiency while minimizing the undesirable effects of interference. NIST will assist both Federal and commercial users by developing these metrics.

In addition, efficiencies are also gained by advances in a number of wireless technologies. Several of these technologies require improvements in measurement technology, both to characterize interoperability, and to provide testing for research and development. For example, adaptive antennas can provide substantial efficiencies, but current antenna measurements used to certify systems are costly and use techniques that are not scalable to the level of adaptivity needed to meet desired efficiencies.

Finally, there are moves to open up very high frequencies in the millimeterwave band that are not used for mobile communications. Developing mobile technologies in this band requires new test equipment that works at much higher bandwidths and frequencies than current equipment, and requires measurement traceability. In addition, basic parameters such as the radio wave propagation are not fully understood, leading to a lack of channel models that form the basis of standards. NIST measurements can enable more accurate characterization of this higher frequency operation that will enable industry to develop network protocols and transmission formats and standards for operation at millimeter-wave frequencies.

Question B: How would a \$9 million increase to a government program really help that much?

Answer B: This funding is narrowly applied to the development of measurements and standards that enable the development of technology improvements, so modest funding can provide substantial leverage to the private sector that will use these tools to develop and manufacture products. Industry typically focuses research and development funding toward more applied issues specific to their own product roadmaps, and not on the underlying basic measurement science that supports and advances the entire industry. By ensuring that a solid measurement infrastructure exists that can address forward-looking needs, industry is not slowed by development missteps, interoperability problems, manufacturing yield issues, or vendor disagreements that are caused by measurement errors or lack of measurement traceability.

Spectrum sharing and coexistence of systems is a powerful method of increasing spectrum utilization, but is a relatively new concept for many applications. In

addition, sharing can be contentious, and multiparty agreements difficult to reach when trustworthy data is lacking. NIST is well positioned to provide neutral, unbiased measurements that can provide data-driven spectrum sharing decisions, and increase the adoption of various sharing technologies.

Background

The NIST request seeks \$5 million for a new "manufacturing entrepreneurship" initiative, which would help people receiving crowdfunding by creating "knowledge libraries". It would also help sign them up for other government programs.

Question: We've seen multi-billion dollar companies emerge from Kickstarter, which they built without a federal manufacturing entrepreneurship program. Isn't the point of Kickstarter to allow people to bring their products to market with private capital?

Answer: The Manufacturing Entrepreneurship initiative will provide technical assistance to makers and other manufacturing entrepreneurs seeking to scale up production. By making these additional resources and information more readily available and accessible, makers around the country will have more tools at their disposal to strengthen their own entrepreneurial ideas. This initiative will harness existing knowledge and resources for the benefit of manufacturing entrepreneurs and facilitate their growth by developing new models for collaboration between entrepreneurs, commercial manufacturers, and government agencies. The program is not intended to provide direct funding to entrepreneurs and it is not a surrogate for private capital.

Question B: Do we really need a new federal government program?

Answer B: A constant theme of recommendations over the past 10 years from the National Academies report "Rising Above the Gathering Storm," which led to the America COMPETES Act, to recent recommendations from the President's Council of Advisors on Science and Technology, have highlighted the importance of a strong innovation ecosystem as a contributor to economic growth and competitiveness. Furthermore, these reports and recommendations highlight the important role that the Federal Government plays in supporting this ecosystem through investments in science and technology and the dissemination of knowledge and data. This investment will help existing programs like the NIST laboratories and the Manufacturing Extension Partnership to disseminate scientific and technical data and best practices to a broader community of entrepreneurs.

Question C: Shouldn't NIST focus on standards and measures?

Answer C: NIST's measurements and standards mission is and will be our top priority, and the President's FY2016 budget request reflects this with an additional \$79.2 million in funding for the NIST laboratories to address measurement R&D needs in areas including advanced materials, quantum sensors, advanced communications, cryptography, and manufacturing. The manufacturing entrepreneurship initiative will help provide the tools to disseminate the knowledge and data derived from those investments to new communities of entrepreneurs who work outside the traditional university and industry sectors.

Cybersecurity Executive Order

Two years ago, the President signed an executive order to improve the cybersecurity of critical infrastructure. The order required NIST to develop a cybersecurity framework that sets standards for protection of critical infrastructure, and it published this framework a year ago. Also, earlier this month, the President issued another executive order encouraging greater information sharing between the government and private sector on cybersecurity threats. The Department plays a role in that order, although the order tasked a non-profit organization to develop information sharing standards.

Question: Can you explain the Department's role in carrying out these orders?

Answer: As an agency in the United States Department of Commerce, NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. NIST is also responsible for establishing computer- and information technology-related standards and guidelines for federal agency use. To meet this responsibility, NIST works with other government agencies, industry, academia and standards bodies. Private sector organizations frequently use these standards and guidelines voluntarily, especially those related to information security, because of their quality and utility.

NIST and other Department of Commerce bureaus are working with agencies specified in the respective Executive Orders, and with industry, to accomplish its tasks using existing authorities.

The President issued Executive Order (EO) 13636, *Improving Critical Infrastructure Cybersecurity*, in February 2013. This EO directed NIST to work with stakeholders to develop a voluntary framework – based on existing standards, guidelines, and practices – for reducing cybersecurity risks to critical infrastructure. This Framework was created through collaboration between industry and government and was issued in February 2014.

The President issued Executive Order 13691, *Promoting Private Sector Cybersecurity Information Sharing*, in February 2014. Section 3(d) of this EO specifies that NIST and other agencies perform a consultative role to the Department of Homeland Security in the development of needed standards.

Question B: Why is NIST in charge of developing standards for the first order but a non-profit is for the second?

Answer B: NIST is not in charge of developing standards for Executive Order 13636. Executive Order 13636 called upon NIST to work with industry to identify an example set of *existing* standards and best practices to meet the specified goals. This Executive Order states that, "The Cybersecurity Framework shall incorporate voluntary consensus standards and industry best practices to the fullest extent possible. The Cybersecurity Framework shall be consistent with voluntary international standards when such international standards will advance the objectives of this order, and shall meet the requirements of the National Institute of Standards and Technology Act, as amended (15 U.S.C. 271 *et seq.*), the National Technology Transfer and Advancement Act of 1995 (Public Law 104–113), and OMB Circular A–119, as revised."

As stated in EO 13691, *Promoting Private Sector Cybersecurity Information Sharing*, NIST provides a consulting role to DHS. As appropriate, NIST will share its work with voluntary international standards organizations in support of information sharing.

Question C: The framework was published a year ago. Has it been effective in protecting critical infrastructure?

Answer C: Since the Framework's release in February 2014, industry awareness and use of the Framework is increasing. It is being employed to improve cybersecurity of critical infrastructure, but it is also being embraced by companies in other sectors. Uses include assisting companies to improve situational awareness and decision making by understanding risks, the degree and appropriateness of their current cybersecurity approaches, and the variety of options for better aligning and prioritizing their resources to get the most out of their cybersecurity investments. The Framework is also being used as a basis for security-oriented discussions and decision-making in corporate boardrooms, by executive leadership, among line managers and staff with cybersecurity responsibilities, and among suppliers and customers within a supply chain.

Framework effectiveness depends upon each organization's goal and approach in its use. Is the organization seeking an overall assessment of cybersecurity-related risks, policies, and processes? Is it seeking a specific outcome such as better management of cybersecurity with its suppliers or greater confidence in its assurances to customers? Is it seeking to establish an effective cybersecurity program from scratch? Is it seeking to demonstrate an effective cybersecurity approach as a means to obtain affordable cybersecurity insurance? Effectiveness measures vary per use case and circumstance. Accordingly, the Framework leaves specific measurements to the user's discretion. Individual entities may develop quantitative metrics for

use within that organization or its business partners, but there is no specific model recommended for measuring effectiveness of use.

Question D: The framework is a voluntary standard. Has private sector adoption been widespread?

Answer D: Use of the Framework is growing. Organizations such as Intel, Chevron, Walgreens, Pepco, Apple, QVC, Unisys, Silver Star Communications, and the Bank of America are using the Framework in a variety of ways. Many have found it helpful in raising awareness and communicating with stakeholders within their organization, including executive leadership. The Framework is also improving communications across organizations, allowing cybersecurity expectations to be shared with business partners, suppliers, and among sectors. By mapping the Framework to current cybersecurity management approaches, organizations are learning and showing how they match up with the Framework's standards, guidelines, and best practices. Some parties are using the Framework to reconcile and de-conflict internal policy with legislation, regulation, and industry best practices. The Framework also is being used as a strategic planning tool to assess risks and current practices.

The Honorable Representative Honda
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on the Department of Commerce FY 2016 Budget Request

High Performance Computing (HPC)

Secretary Pritzker, high performance computing (HPC) is critically important to NOAA for meeting its mission requirements, which is why NOAA began an initiative in 2010 to install its first leadership-sized supercomputer, called Gaea. While Gaea is providing an invaluable service to NOAA today, it has a limited life span and must be recapitalized. The FY16 Budget requests an increase of \$9,000,000 to begin recapitalization of the R&D High-Performance Computing (HPC) systems (i.e., Gaea) located at Oak Ridge National Laboratory in Oak Ridge, Tennessee and to establish a permanent source of funding that would allow NOAA to maintain regular refresh and recapitalization of supercomputing resources. A portion of the increase would be used to provide additional HPC capacity to support regional sea level rise modeling.

Question: How has supercomputing been able to contribute to NOAA's missions, and what has been your experience since 2010 using world-class high performance supercomputing?

Answer: NOAA's environmental modeling enterprise underpins most of NOAA's products and services, from short and long-term weather forecast and prediction to coastal modeling to ecosystem modeling for fisheries management. NOAA's R&D HPC assets are part of the critical infrastructure required to accomplish its mission. Since 2010, NOAA has successfully installed and maintained four major R&D HPC systems (Gaea, Zeus, Theia, and Jet). Every NOAA line office uses at least one of these systems to execute its mission. The following are examples of major mission accomplishments enabled by NOAA's investments in R&D HPC.

Improved seasonal predictions of extreme weather (including hurricanes), temperature, and precipitation predictions due to the ability to run models at higher resolution. Higher resolution models can more accurately take into account variables, such as topography, that affect seasonal predictions. Implementation of a finer resolution Global Forecast System model (from 27 km to 13 km), which has led to more accurate weather forecasts. Quantitative, reliable prediction of climate-driven impacts on marine resources has helped improve the effectiveness of NOAA's ecosystem-based marine resource management. Recent NOAA research results have linked climate change to impacts on endangered leatherback turtles in the eastern Pacific Ocean, shown how changing ocean conditions may challenge Atlantic Cod, and linked climate change to impacts on rare ground fish species in the Northeast U.S. Unraveling these interactions is a complex, cross-disciplinary problem requiring computationally intensive models and data corroboration that requires access to the largest high-performance computers.

Question B: Please explain NOAA's plan to recapitalize its high performance supercomputing systems generally, at Oak Ridge National Laboratory particularly. What benefits that would result? How does this fit into the Administrator's investment priorities?

Answer B: In the FY 2016 President's Budget, NOAA has requested \$9 million to recapitalize Gaea, the HPC located at the Oak Ridge National Laboratory. This funding for HPC capacity supports the Department and NOAA's goals of evolving the National Weather Service and building resilient communities by making model improvements that will:

- improve seasonal forecasting of tropical cyclone activity;
- expand high-resolution ocean models that will take into account improve predictions of global and regional sea level rise and coastal management;
- improve high-resolution modeling for skillful seasonal predictions of temperature and precipitation and their extremes; and
- include fully interactive chemistry and aerosols in high-resolution coupled models which will allow NOAA to better predict the regional impact of pollution on human health, ocean acidification, and the recovery of the stratospheric ozone layer.

Question C: What is the status of NOAA responding to Appropriations Committee language requiring submission of a long-term plan to upgrade its high performance computing technology and architecture?

Answer C: NOAA is currently working on a report regarding our long-terms plans on high performance computing (HPC). NOAA intends to deliver the report to the Committee as soon as possible, but past the June deadline (180 days after enactment) requested by the Senate. Additional time is needed to draft and review the report due to the complexity of this topic.

Question D: What would be the impact if Congress did not fund the \$9 million requested this year in terms of NOAA's ability to perform its primary missions, and the cost and research implications for the Agency of deferring the project to another fiscal year? How would research capability be degraded?

Answer D: Without the requested funding, NOAA will have to fund recapitalization of the Gaea supercomputer within current resources, resulting in diminished R&D HPC capacity (approximately 50 percent of the capacity of today's system). This will result in loss of high-resolution modeling capability for skillful seasonal predictions of surface temperature and precipitation, the understanding and prediction of tropical cyclones, and slow down mission critical scientific advancements and transition of research into operational applications. It will take NOAA at least five years to recover its current capability if recapitalization has to be done within current resources.

Hollings Manufacturing Extension Partnership (MEP)

I'm pleased to see the \$141 million request for NIST's Hollings Manufacturing Extension Partnership (MEP) to support the competitiveness of small and medium size manufacturers across the country. MEP centers provide a variety of important services, from innovation strategies to process improvements to green manufacturing. They also work with partners at the state and federal levels on programs that put manufacturers in position 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 home on our shores.

Question: In light of various GAO and Commerce Department driven reports addressing the Manufacturing Extension Partnership (MEP) cost share issue, what actions is the Department taking to ease the significant cost share burden local MEP centers across the country are having to shoulder as a result of having many states curtail or even eliminate their one-third cost share of this critically needed program to sustain and expand small and medium size manufacturing in the U.S.?

Answer: Over the past few years the concept of moving the MEP Center non-federal/federal cost share requirement from 2:1 to 1:1 has been extensively studied and reaffirmed by the National Academies of Science, the private sector MEP Advisory Board, and NIST. In 2014, NIST MEP began a multi-year competition of the MEP Centers. The competition allows the program to adjust the federal investment in each state, which insures individual Center funding is more closely aligned with the percentage of manufacturing in the Center's state. The competition will also enable an immediate change to a 1:1 cost share for Centers. This will provide short term cost share relief for the first three years of the Center's operation -- as the percentage of non-federal funding grows after year three. Meanwhile the Department continues to provide analysis to the House and Senate authorizing committees to demonstrate the benefits of a permanent change to the 1:1 cost-share ratio in MEP's authorizing legislation which is currently included in HR 1806, America COMPETES Reauthorization Act of 2015.

Question B: I understand that several MEP centers are actively working with local workforce investment boards resulting in very positive job impacts in terms of skilled jobs retained and created. For example, through the collaborative efforts of the MEP centers serving northern and southern California-namely, CMTC and Manex, we now have a manufacturing sector layoff aversion business assistance program in our state. What have been the outcomes for this type of program and what steps, including funding allocations, is the Commerce Department taking to scale up these successful job-sustaining initiatives? How is the Commerce Department working with the Labor Department to accelerate these efforts in my state and elsewhere?

Answer B: As you know, workforce issues are a major concern for small and medium-sized manufacturers, and MEP Centers work with their local and state workforce partners to develop innovative joint strategies to address the workforce needed by the manufacturing industry.

In 2014, impacts of the California MEP Centers partnership with the Workforce Investment Board in the Manufacturing Sector Lay-Off Aversion and Business Assistance Program are:

- more than 220 manufacturers served,
- 2,833 jobs created or maintained.

MEP has been working with the Department of Labor (DOL) to scale up the lay-off aversion assistance. To this end, DOL will be part of a joint meeting with MEP Centers this summer to share current joint projects and discuss ways to enhance the relationship and create new program opportunities.

DOL is committed to including MEP Centers as potential partners in upcoming competitive grants. Most recently, the DOL *Apprenticeship Grant* referenced MEP Centers as potential partners, and the new *Sector Partnership National Emergency Grant* (released April 29, 2015) includes MEP as potential strong partners for this workforce grant.

Question C: While I'm pleased to see the Commerce Department's efforts to establish regional collaborative networks in manufacturing innovation, it is important that these initiatives fully integrate the process and production innovation work of the MEP centers into the networks so that the work of the MEP centers in assisting small and medium sized manufacturers is enhanced and the MEP centers are an essential program component of these networks and other Department advanced manufacturing initiatives. What specific program and funding actions will the Commerce Department be proposing to integrate the MEP centers into the manufacturing innovation networks? In my state, our MEP centers already actively collaborative with the national labs on technology transfer and improvement for small and medium size manufacturing; how would you envision using this enormous resource as you move your manufacturing initiatives forward?

Answer C: NIST MEP is working in a number of different areas with respect to integrating MEP Centers into regional and national manufacturing innovation initiatives. The collaboration in California, with Lawrence Livermore and Lawrence Berkeley National Laboratories is part of the California Network for Manufacturing Innovation (CNMI). Investments from NIST MEP led to the development of a guidebook for creating such technology collaboratives based on the CNMI experience and have since used it to establish similar collaboratives in Nevada, Massachusetts and Virginia utilizing relevant industry partners and a variety of other resources, such as the federal laboratories, universities, community colleges and state and local agencies.

In addition, to support the National Network for Manufacturing Innovation (NNMI), NIST MEP is working with the Departments of Defense and Energy to support their investments in the first five Manufacturing Institutes to ensure smaller manufacturers are involved in four ways: awareness of technologies and their implications; informing research agendas; participating in research projects; and, ensuring that the results are disseminated for implementation by smaller manufacturers.

NIST MEP is finalizing a model Memorandum of Understanding with the Department of Defense to provide a framework for broad collaboration between the MEP program and the DoD activities.

Individual MEP Centers are already partnering directly with the manufacturing institutes, for example the Michigan Manufacturing Technology Center (MMTC) announced partnership with the Lightweight Innovations for Tomorrow (LIFT) institute in Detroit. Their partnership will provide SMEs with "the ability to connect with lightweight engineering experts and to be part of projects for testing and verification purposes."

NIST MEP is also investing in exploring specific opportunities in robotics, flexible automation, and predictive maintenance with the NIST labs to transition work in the labs to companies through the MEP centers.

**The Honorable Ranking Member Chaka Fattah
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on the Department of Commerce FY 2016 Budget Request**

American Community Survey (ACS)

Question: With regard to the American Community Survey (ACS), in what ways would the quality and/or cost of the survey be impacted if the ACS became voluntary rather than mandatory? Have studies been conducted on this question, and what were the results?

Answer: The U.S. Census Bureau conducted a test from March through June 2003 to assess the impact of implementing the ACS as a voluntary survey rather than a mandatory survey. The test found a dramatic decrease in mail response rates when the survey was voluntary, leading to a significant negative impact on the reliability of the estimates[1]. Given improvements in the ACS methods that have been implemented since the 2003 test, additional analysis was conducted in 2012 to estimate the impact on costs and reliability[2]. This research showed that to compensate for the decreased mail response rates it would cost an additional \$90 million or more annually to maintain the current data quality. That would involve sending the survey to more than one million additional households.

[1] See http://www.census.gov/acs/www/Downloads/library/2003/2003_Griffin_01.pdf for detailed findings.

[2] See http://www.census.gov/acs/www/Downloads/library/2004/2004_Griffin_02.pdf

Question: In what ways would the reliability of data in rural counties and small cities and towns be impacted by changing the ACS to a voluntary survey?

Answer: To maintain current data quality in the face of lower response rates to a voluntary ACS, we would need to increase the survey sample size by more than one million households each year. Otherwise, based on 2006-2010 data, we estimate the ACS would not be able to produce reliable, usable data for 25 percent of the counties in the United States (which represent 61 million people); of the 751 counties that would be impacted, most of them smaller and rural.

The analysis was repeated using the 2009-2013 ACS 5-year data. Now, we estimate that the ACS would not be able to produce reliable, usable data for 16% of counties in the United States, which represents 31 million people.

Question: In what ways do the private sector and other nongovernmental entities in the United States utilize data from the American Community Survey (ACS)? How would the value of this data be impacted by changing the ACS to a voluntary survey? How would other Federal programs be impacted by this change?

Answer: The ACS is vital to small and large businesses to better serve the full range of markets, find workers with the needed skillsets, and inform decisions on where to invest and create jobs. Local communities rely on the ACS to locate schools, first responders, roads, hospitals, and to target resources to areas in need of assistance. The Federal government uses the ACS to distribute over \$400 billion a year in Federal funding to our communities, in addition to using the ACS to make our government run smarter and more efficiently. Other Federal programs would have difficulty executing on their missions without ACS data. For example, the Department of Veterans Affairs tells us that ACS data is vital to their ability to allocate funds for employment and job training programs for veterans, plan cemeteries, determine who may not be receiving medical services, as well as budget and plan for nursing homes and medical facilities.

Question: Is it possible that the business sector could replicate the breadth, depth, and quality of data the ACS produces, for every community in the country? Would businesses charge Congress and Federal agencies to use the data under this scenario?

Answer: The Decennial Census, including the American Community Survey, is a uniquely Federal function required by the U.S. Constitution. Every year, Census and ACS data are used to distribute over \$400 billion in Federal funding; much of it to state and local governments. The American Community Survey collects consistent, comprehensive, and comparable information for every state, county, and city—both urban and rural—and utilizes the existing management, survey design, data collection and processing infrastructure of the Census Bureau to do this. No other agency or private firm currently has the capability or capacity to do this on a national scale in such a way as provide data of the same quality and timeliness, and they could not gain such abilities without substantial cost. One of the great advantages of having these data collected by the Census Bureau in one survey is that it is much more efficient than each agency individually paying to collect data on its own to administer Federal programs.

Question: Have other countries experienced problems associated with converting census surveys from mandatory to voluntary? What lessons can the United States derive from these experiences?

Answer: When Canada switched to a voluntary survey, it lost the ability to publish data for many rural counties. To compensate for a similar effect here, our research shows it would cost an additional \$90 million or more annually to maintain our current data quality. That would involve sending the survey to more than one million additional households. If the sample size weren't increased to offset the voluntary impact, the number of counties with substantially unusable data would increase from five to 25 percent.

Question: Critics of the American Community Survey complain that the survey is too intrusive and burdensome. What steps has the Census Bureau taken recently to address ACS respondent burden? How does the Census Bureau ensure the privacy of individuals and households who participate in the American Community Survey?

Answer: We understand the concerns respondents have and are working to address them. We are exploring the possibility of using other data sources including information people have provided to the government and commercial entities which could allow us to remove some questions. In addition, we are researching how we might better phrase some of our questions to not only reduce concerns for those who may be sensitive to providing information, but also for those that find them confusing. Further, we are researching the possibility of asking some questions every other year, or every third year, as well as asking some questions of a smaller sample of respondents. Finally, we are experimenting with our interviewing protocol to identify ways we can make fewer in-person contact attempts to obtain interviews as well as place fewer calls to respondents while still gathering the data our nation needs. In 2013 we reduced telephone follow-up contact attempts by 1.2 million calls. We will also be providing more information in the survey on why we ask each question and how it benefits the respondent and our nation.

Protecting the privacy of individuals' information is a core Census Bureau value and essential to our mission. We work with the National Institute of Standards and Technology and the Department of Homeland Security to ensure our security measures follow their best practices. The Census Bureau has a comprehensive, layered defense system to protect the data it collects.

The Census Bureau:

- limits physical and information technology access to protected data strictly to the persons that need access. (Each program strictly reviews and authorizes such access.)
- uses logical access to ensure authorized staff only can reach the servers and specific data types that they need access to.
- encrypts protected individual data records when collected online in accordance with Department of Homeland Security trusted internet connection provisions.
- scans all email traffic to prevent unauthorized disclosure.
- conducts continuous monitoring of all information technology systems.

- requires every employee to complete annual data stewardship and information security training.

The Honorable Representative Jaime Herrera Beutler
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on the Department of Commerce FY 2016 Budget Request

National Marine Fisheries budget

The Commerce budget includes important elements that provide for managing our nations marine fisheries, inside the NOAA budget, within the National Marine Fisheries budget. The roles and activities of the Regional Fishery Management Councils within the National Marine Fisheries budget are very important to me and my constituents. However, I am concerned that the President's budget may not sufficiently provide for conducting all their responsibilities under the Magnuson-Stevens Act. Thus a few questions:

Question: I understand the Regional Fishery Management Councils have been asking the NOAA Assistant Administrator in charge of the National Marine Fisheries Service (NMFS) for additional funding just to do the routine matters of setting offshore fishing seasons and catch regulations—can you explain how you determined the amount to be provided to the Councils in this budget?

Answer: In FY 2015, the Councils received a total of \$27.9 million, an increase of almost \$0.7 million from FY 2014. The funding is divided among the eight Councils and is used for their operating costs such as staff costs, rent, public meeting costs, Council member salaries, and travel. Most of the support for the Councils comes from the Regional Councils' and Fisheries Commissions' budget line. Funding from this budget line is sent to the Regional Councils and State Fishery Commissions through grants from their NMFS Regional Offices. In addition, the Councils receive support from other appropriate budget lines to support activities including National Environmental Policy Act (NEPA) implementation, stock assessments, and other fisheries research.

When Congress made changes to the federal fishery management statutes that required additional resources for implementation, the Administration requested and received significant increases to support the Councils' role. For example, following the 2007 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act, the Councils received an additional \$4 million to prepare and process the changes to their Fishery Management Plans putting annual catch limits in place. These increases allowed NMFS and the Councils to effectively put new measures in place in compliance with Congressional direction. Each year, NMFS also attempts to add adjustments to the base funding to account for increases to standard costs.

NMFS meets with the Executive Directors from each Regional Council two times each year at Council Coordinating Committee meetings so that the Councils can raise issues and concerns with NMFS leadership about their current and anticipated future needs. NMFS continues to work closely with the Councils to anticipate resource gaps and needs in fishery management, and includes these requests in budget proposals when appropriate

Question B: I understand that in the FY 2015 budget, the eight Fishery Councils began to be charge a 3.99% fee to fund NMFS Administration "Common Services", along with every NMFS line item, and that this FY 2016 budget also plans for this fee to be charged. However, the Regional Councils do not use many of the "common services" that this fee funds, such as HR services, and they have objected to being subjected to this administrative fee. Why do you think it is appropriate for the Regional Councils to pay for administrative common service they do not use?

Answer B: Management and Administrative (M&A) costs were charged to the Regional Councils Program, Project and Activity (PPA), which amounted to about a four percent charge in FY 2015. M&A costs are charged equitably to all NOAA PPAs except those specifically exempted. These costs help to pay for general management activities, financial oversight, budgeting, and grant costs associated with expenses in NOAA organizations and lines. M&A costs are a fundamental component of the full costs necessary to complete NOAA's mission and objectives. In the specific case of the Regional Councils, which receives grant funding from NOAA, the M&A charges help to fund the necessary functions of NOAA Fisheries grants management, ensuring that the Councils receive their funds to operate in the most efficient and effective manner possible.

In addition, NOAA's M&A policy is in accordance with OMB Circular A-123, "Management's Responsibility for Internal Control," and the methodology is outlined in the NOAA Finance Handbook. M&A costs represent activities performed centrally that support multiple components of the respective organization, rather than a single program. Chapter 12 of the NOAA Finance Handbook outlines equitable treatment of M&A costs, as it is not possible to attribute M&A functions and its related costs to a specific program.

Question C: The President's Budget calls for an additional \$5 M to develop electronic monitoring capabilities in marine fisheries. Do you propose that any of this additional funding be provided to the Regional Councils to fund their role in the electronic monitoring regulation development process? If not, why not?

Answer C: The FY 2016 President's Budget requests a total of approximately \$7.0 million to support further development of cost-effective, appropriate technologies for monitoring federal fisheries. Of this amount, \$5.6 million is requested within the Fisheries and Ecosystem Science Programs and Services for development, testing, and installation of electronic monitoring and reporting technologies across the country. The remaining \$1.4 million is requested under Fisheries Management and Programs and Services to establish the regulatory framework needed to integrate electronic technologies into fishery-dependent data collection. We anticipate the Councils' base funding to provide adequate support for their role in the electronic monitoring regulation development process. As electronic monitoring pilot projects are completed, NOAA and the Councils will have a clearer picture of how the increased use of these technologies will work in practice, and what support will be needed to implement changes in the fishery management regulations.

Each NMFS region worked with its respective Regional Fishery Management Councils (and advisory panel in the case of Atlantic Highly Migratory Species) to create an electronic

technology implementation plan that will promote adoption of appropriate technologies. These plans identify, evaluate, and prioritize implementation of promising electronic technologies to enhance fisheries-dependent data reporting and monitoring. The regional plans were completed in January 2015 and are now publicly available (<http://www.st.nmfs.noaa.gov/advanced-technology/electronic-monitoring-and-reporting>). The plans outline several regional electronic technology programs (e.g., Alaska, West Coast, and Northeast) poised to be implemented by 2018. The implementation plans are a milestone in an ongoing effort to improve the timeliness and quality of fisheries information. The \$5.6 million proposed for FY 2016 would support implementation of electronic monitoring and electronic reporting projects that were prioritized by NMFS and the Councils under their respective electronic technology implementation plans.

Question D: Similarly, this budget proposes and additional \$5 M for Essential Fish Habitat identification and protection—do you propose that any of this additional funding be provided to the Regional Councils to fund their role in the Essential Fish Habitat provisions of the Magnuson-Stevens Act? If not, why not?

Answer D: The \$5.7 million increase requested in the FY 2016 President's Budget for Essential Fish Habitat (EFH) consultations is not proposed to go to the Councils. However, NOAA's implementation of these funds will directly benefit the Council's work and the species they manage. Through the Council process, Councils identify EFH and recommend any required protection measures to NOAA Fisheries. NOAA Fisheries' primary habitat-related mandate under the Magnuson-Stevens Act is the protection of EFH from non-fishing actions or proposed actions authorized, funded, or undertaken by other federal agencies. Currently, NOAA Fisheries has a significant capacity gap for conducting required consultations with these federal agencies, and is unable to review approximately 25 percent of proposed projects each year that may adversely affect EFH. Such projects may degrade habitats that the Councils and fishing-dependent communities rely on to sustain and rebuild commercial and recreational fish stocks, which provide 1.7 million jobs and nearly \$200 billion annually to the U.S. economy. Additionally, working cooperatively with other federal agencies on these consultations allows for critical and economically important transportation and infrastructure projects to move forward, while minimizing the negative impacts to the EFH on which fisheries and local communities depend.

Question E: Do you have any plans to engage the Regional Councils to consult with them on how much funding is necessary for them to execute the priorities identified in the President's budget, or future budgets, associated with implementation of the Magnuson-Stevens Act? If you have plans, could you briefly explain the anticipated process? If you do not have plans, what do you think would be a good process to follow?

Answer E: NOAA Fisheries (NMFS) meets with the Executive Directors from each Regional Council two times each year at Council Coordinating Committee meetings. These meetings provide a forum for the Councils to raise issues and concerns with NMFS leadership about their current and anticipated future needs. Feedback from these national meetings is used by NMFS as they develop their future budget requests. In addition, feedback from Regional Council meetings, which are attended by leadership from their respective NMFS Regional Offices, can provide additional information for NMFS to consider in future budget requests. The

most significant needs for funding increases to the Councils have come when Congress has made changes to the federal fishery management statutes. When this occurred, NMFS worked with the Councils to anticipate these new gaps, and included these in our funding requests. In the future, NMFS will continue to work closely with the Councils to ensure they have the support they need to carry out their mission.

WEDNESDAY, MARCH 18, 2015.

**NATIONAL OCEANIC AND ATMOSPHERIC
ADMINISTRATION**

WITNESS

KATHRYN SULLIVAN, ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Mr. CULBERSON. The House Appropriations Committee for Commerce, Justice, and Science will come to order.

And I want to welcome everyone to this morning's hearing with Dr. Kathy Sullivan, the Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator.

We deeply appreciate your service to the country, Dr. Sullivan. We look forward to hearing from you and asking questions about your budget for the coming year.

And we have a particularly difficult budget year recognizing the immense importance of the work that NOAA does from weather forecasting to ocean research. We want to make sure we get our weather satellite system, and make sure there are no gaps in coverage there, of course.

But it is an extremely difficult budget year and we are, as good stewards of our taxpayers' hard-earned tax dollars, going to have to be sure we are limiting our investments to our top priorities, while recognizing that you have asked for about a ten percent increase above the current fiscal year.

In your budget request for 2016, you are asking for \$5.9 billion, an increase of about \$540 million dollars. We will certainly do our best to be sure that top priorities of NOAA are funded, but, I want to make sure it is clear for the record with every one of our other witnesses, that we are facing a very difficult budget environment and many of the assumptions that the President makes in his budget are not going to happen such as tax increases and fee increases, et cetera. These are just simply not realistic.

But we will, of course, do everything we can to protect the important work that NOAA is doing. Weather forecasting is so vital, and the work that you are doing in ocean mapping and exploration is absolutely essential. And we will do our very best to protect you.

The work that we do has always been bipartisan in nature. This subcommittee's devotion and support for the sciences and scientific research, space exploration, weather forecasting, and law enforcement is a long tradition of the subcommittee.

It has been a privilege for me to be a part of it since I first got on the Appropriations Committee and particularly to succeed my mentor and dear good friend, Frank Wolf, who we all have great memories of and I do my best every day that I have got this job to live up to the high standard Frank Wolf set.

It is a privilege to have you with us here today. And I would like to recognize my good friend, Mr. Fattah, for any opening statement he would like to make.

Thank you.

Mr. FATTAH. I want to thank the chairman for hosting you and this hearing is an important part of our decision-making process. So I want to say a number of things.

One is that you have a distinction, you know, in terms of not just your service at NOAA but as one of the first women astronauts and walking in space, so you are an important example of the impact science can have in the life of our Nation.

NOAA is a critically important agency and I have been over to visit at the National Weather Service. I got a chance to keynote or talk at the conference that was held on severe weather events. We have a lot going on not just in terms of your normal work but the challenges related to weather and the historic high in terms of severe weather events.

The work that NOAA has done to make advancements in weather forecasting has helped save lives and protect property throughout the country, and also it is critically important for navigating our waters for commerce and for troop deployments. We need information through NOAA. And the work of the Administration to create an ocean policy, I think, has been very important.

I was at their coastal zone conference in Chicago a few years back where I got a chance to speak, but more importantly to learn about the important efforts of NOAA all the way to and including the Guard Club of America and their tremendous support. They were just here on The Hill a few weeks ago talking to Members and making it abundantly clear these 11,000 volunteers, how important your work is.

So I want to welcome you. Look forward to your testimony.

And I thank the chairman. And, again, I apologize for being a couple minutes late. But I was with Tom Cole and he said he would give me a slip if I needed one. But we were trying to conclude work on Labor HHS. So thank you, Chair.

Mr. CULBERSON. Thank you.

Mr. FATTAH. All right.

Mr. CULBERSON. That is impressive.

Mr. FATTAH. Well, conclude today's activities, yes.

Mr. CULBERSON. Thank you very much.

Dr. Sullivan, it is a pleasure to have you here with us and we will without objection submit your full statement for the record in its entirety, and welcome your summarization of your testimony. And we are pleased to have you here today and would recognize you for your presentation to the subcommittee. Thank you, ma'am.

Ms. SULLIVAN. Thank you, Mr. Chairman, Mr. Fattah, and Members of the subcommittee. I am quite pleased to be here today and talk about NOAA's fiscal year 2016 budget request.

I would agree with both the chairman and the ranking member's assessment that NOAA is one of the most valuable service agencies in the United States Government. Through our observations, our forecasts, and assessments, we strive to provide the foresight and information that people need to live wisely and well on this dy-

dynamic planet. At NOAA, we call this information environmental intelligence and producing it is at the core of our mission.

Americans from our citizens to our military to our businesses rely upon this environmental intelligence and the services that NOAA provides every single day from forecasting extreme weather events to providing data that help ensure safe navigation, sustaining and promoting economically viable fisheries, and protecting endangered species.

We leverage our capabilities across all of the different scientific disciplines involved to support the Nation in preparedness, response, and recovery.

Our fiscal year 2016 budget builds on the foundation that was established with the support of this committee and the Congress. It sustains our efforts to put critical information into the hands of the public. Each of the increases in our request is a carefully chosen targeted investment in an area that is most vital for NOAA to meet the growing demand we hear from the public. I would like to touch briefly on the four main priority areas of our request.

First, this request invests in observational infrastructure improvements that are needed to effectively execute NOAA's diverse mission portfolio and protect public safety and welfare now and into the future. To ensure the continuity of our at sea data collection capability, one of the most important requests in our budget is funding for the construction of an ocean survey vessel that is capable of advanced oceanographic research in coastal and deep ocean areas.

NOAA's current fleet will decline from the current 16 vessels to just eight by 2028 without continued investment. We will continue to partner as we do now robustly with the private sector to meet our ship time needs, but a combination of contracts, partnerships, and a robust NOAA fleet is clearly a must if we are to continue to provide the critical reliable data that businesses and the American people depend upon.

NOAA must also ensure the continuity of satellite operations to provide the National Weather Service with the data needed for forecasts that protect lives and property. The fiscal year 2016 budget initiates development of a Polar follow-on satellite system that will reduce the potential for gap in these critical observing systems and enhance our ability to provide timely and accurate weather forecasts now and into the future.

Second, this budget proposes to equip communities to face increasingly frequent natural disasters and confront the long-term adverse environmental changes that are seen. 2014 was the warmest year on record with eight weather and climate disasters, each of which had losses totaling \$1 billion. Each of these events causes widespread damage and devastates families, businesses, and communities.

This budget invests in the services and information to support the communities' own efforts to assess their risks and minimize their losses in advance and in the aftermath of such events.

For example, it invests in actionable coastal intelligence tools such as water level data for improved storm surge predictions and nautical charts. It spurs important research to help farmers and coastal communities prepare for and mitigate drought and flooding

and it will strengthen and expand the U.S. seafood industry by tapping into a \$100 billion aquacultural global market for which this country currently only makes up a one percent share.

Third, this budget makes investments to ensure that America has a National Weather Service that is second to none. Weather and climate impact approximately one-third of our Nation's GDP. It can cost billions of dollars and claim thousands of lives per year.

NOAA continues its commitment to build a weather ready Nation and provide citizens with the most timely, accurate, and well-communicated forecast information.

Specifically this budget invests in several targeted areas needed to improve weather service capability and service delivery to meet key user needs. This includes improving the geographic accuracy for hazardous weather and improving the prediction of precipitation and temperature outlooks for the three to four-week range, a time frame that is essential for emergency managers to prepare for and mitigate these extreme events.

And, finally, this budget aims to improve our agency's core operations. Every day NOAA employees strive to execute our mission with discipline and consistency and timeliness. However, we cannot perform our core functions at the highest level when our support services cannot keep pace with the growing demand.

And in recent years, our support functions have fallen drastically behind. This threatens our ability to recruit, retain, and reward the best talent possible and to ensure our customers receive the best service possible. It compromises our ability to engage with the private sector and academia and to provide you with the quality and timeliness of accountability reporting that you rightly expect.

Our fiscal year 2016 request for corporate services is smaller but similar to what we requested in fiscal year 2015 and will focus on improving corporate service functions, in particular in our workforce and acquisition and grants arena.

Overall, NOAA's fiscal year 2016 budget request reflects the commitment of Secretary Pritzker that she and I have made to the President to growing a strong economy that is built to last while being fiscally responsible and focusing on priority initiatives.

I am proud to serve with this vital component of the United States Government helping to maximize United States competitiveness, enable economic growth, foster science and technological leadership, and promote environmental stewardship.

I look forward to working with you, Mr. Chairman, and Members of this committee as well as partners and our constituents to achieve the goals that I have articulated through the implementation of this budget. And I thank you for this opportunity to make a comment.

Mr. CULBERSON. Thank you, Dr. Sullivan. We appreciate your testimony and your leadership of the agency.

And as a father of a daughter who is keenly interested in the sciences, I would, if I could, just like to open by asking you to tell the committee and anyone out there listening, particularly young girls who are thinking about going into the sciences, what led you to major in geology and go on to join NASA. Tell us what led you into the sciences, what inspired you, and talk to us a little about

any barriers that you encountered as a woman, if any, and what you did to overcome those.

Ms. SULLIVAN. Well, it is very kind of you to inquire, Mr. Chairman. I was driven from a very young age by a strong curiosity, basically a strong geographic curiosity about virtually every aspect of geography, landscapes, climate, critters, peoples, cultures.

And, frankly, if you poked me as a little girl and asked me what my dream was, it was to figure out how someone bought me airline tickets so I could actually get to go to all these exotic places and learn firsthand about those phenomena and those people and those places.

I first began thinking I would parlay a strength I have in foreign languages into a career like that and so actually chose my college as a language and linguistics major.

Mr. CULBERSON. What was your focus and what language?

Ms. SULLIVAN. I was already fluent in French and German and I wanted to go into Russian. And happily that college had the wisdom to require me as an arts and language major to take three science courses which I thought was a terrible idea at the time.

They won and I discovered geology and oceanography and saw in the lives and the work of my young professors, all of whom were male, but I admired their curiosity. I admired their spunk getting out into the field. They invited us into the passion that they felt for understanding this planet and how it works and for turning that information, the scientific data into information that could really help people live better.

Mr. CULBERSON. Dr. Robert Ballard's specialty is geology.

Ms. SULLIVAN. Well, and young Dr. Robert Ballard and I went to sea together in 1974 on the cruise that began his arc of fame. He was at that time a very wet-behind-the-ears post-doc who was, frankly, doing all the grunt work for the big names who were aboard—

Mr. CULBERSON. Right.

Ms. SULLIVAN [continuing]. The cruise. I was even more junior to Bob, so I got to do the even grimmer grunt work, but that was quite a remarkable voyage in its own right. And it was those sorts of experiences, the chance to live overseas in Norway for a year for my junior year that reshifted my focus towards geology and oceanography, towards the North Atlantic in particular which is why I studied in Canada.

Barriers to overcome, I was blessed to have parents that inoculated me through their confidence and their composure that any interest their child has is an interest that is valid for that youngster to pursue. And the peanut gallery does not get to edit those choices, but also strong enough to tell me, you know, you have got to work hard at the things you care about. Mastery is an important thing unless you just want to make it your hobby.

And so that gave me, I think, some ability to proceed on an ignorance is bliss basis. If my work was good, I just managed to largely ignore people who thought it was odd that I should be doing this.

You know, it is challenging and you certainly can meet a boss or a mentor or supervisor who more actively tries to hold you back. I was fortunate to not meet any really malicious people who aimed to hold me back, but there were plenty who challenged me hard.

And I think it is fair to say that those of us women in the early days of oceanography and geology and the astronaut corps, I think we certainly had to reach to a higher level to be accredited as basically capable. You know, that is not a bad thing. It does make you stronger.

Mr. CULBERSON. It does indeed make you stronger and it is a great story. And I saw that you were on the mission that deployed the Hubble Space Telescope which continues to—

Ms. SULLIVAN. The 25th anniversary this coming month.

Mr. CULBERSON. Yeah. Continues to give tremendous benefits to all of humanity.

And the Space Program in particular, I know it is a vital part of the work that you do at NOAA and we are, all of us on the committee, concerned. We want to make sure there is as little a gap as possible in our coverage of satellites.

There was some early problems with the management of the Polar weather satellite. We have, all of us on the committee, we reviewed the inspector general's report who points out the potential gap in data between the current on-orbit Polar weather satellite, the NPP, should it fail or if there is a launch failure for the next Polar satellite.

Congress included \$111 million in Hurricane Sandy supplemental to address this gap and the overall lack of program robustness. So we essentially fully funded NOAA's weather satellite procurement request for the last several years.

What distinct actions has NOAA taken to address the potential gap and what is your best estimate on the length of the gap that might occur and what could we do, if anything, to move up the launch of the JPSS-1?

Ms. SULLIVAN. Thanks for that question.

We have done a number of things. One is, really along with our partners at NASA, we looked carefully at how we are managing the current primary satellite, the NPP satellite, making sure that we are working well within margins, we are not over-straining systems, doing everything we possibly can within the operations of that satellite itself to up the likelihood that it will last to and beyond its design life.

That is all going to be statistics. You can make a guess. Mr. Fattah can make a guess. Mrs. Herrera Beutler can make a guess. And a micrometeorite could hit it tomorrow or—

Mr. CULBERSON. Right.

Ms. SULLIVAN [continuing]. It could run for a long time. So we are doing that. We are doing everything we can to extend the life of NPP.

We scrubbed the JPSS-1 procurement schedule very assiduously again with our NASA colleagues and our vendors. We have pulled that to the left as far as it is technically possible to do. The big constraint there are the long lead parts and the intricacy of assembling the primary instruments that make the key vertical profiles of the atmosphere. There is just only so much that our vendors tell us they can compress that given the realities of their supply chains.

Thirdly, you will recall we mounted an array of activities with, in particular, the Sandy supplemental funds aimed at inoculating

ourselves in every other way we could against a loss of data. So factors that feed into that are improvements in our operational super-computing capacity at the Weather Service, improvements in what is called data assimilation, the mathematics by which you pull the data into the system. That actually can play a significant role in the skill, the final result of a model.

We have been doing some assessments of whether short-fill temporary data sources, how might they make up for a loss of JPSS satellite from purchasing more aircraft data. We buy data from commercial suppliers of measurements from airplanes, for example.

The key contributor there is the COSMIC radio occultation system. There is a COSMIC version 1 in orbit now but well past its design life and our focus on securing all 12 of the COSMIC-2 sensors goes very directly to the notion that they can play a significant role should we lose Polar satellite data.

Mr. CULBERSON. What is your best estimate today of the potential gap and when is your best estimate on when you can launch and what, if anything, can we do to help speed that up?

Ms. SULLIVAN. JPSS-1 has been meeting every budget and schedule target consistently for the last 24 months. The program has retired those management risks that were a problem in the 2009, 2010, 2011 time frame. Our GAO colleagues concur in that assessment. It is now a stable and well-managed program. It is on track to launch in the very beginning of calendar 2017.

I would have to pick a random number, Mr. Culberson. You would have to decide what probability of a failure do you want me to calculate the number on. And you can get a range from 12 to 14—

Mr. CULBERSON. Your best personal estimate.

Ms. SULLIVAN. Depending how you cull the statistics, you could say it is a 12 to 14 or 18 month. And there are more cautious or worried people who would say, oh, it could be 36 or 48 months. It entirely depends on what—

Mr. CULBERSON. Sure.

Ms. SULLIVAN [continuing]. Probability. If you want to tell me I want a 90 percent probability or 80 or 40 or a 30, that gap length will vary significantly. So it is a pretty random exercise to try to pick a gap length.

Mr. CULBERSON. It sounds like from your answer there is not much we could do to speed that up. The supply chain, your vendors tell you there is only so much they can do. Not much then this subcommittee could do to help you speed up or make that launch date any earlier than early 2017?

Ms. SULLIVAN. We have turned over every rock and we have asked them point blank if we could provide an additional slug of money, can we change this. And they tell us they cannot. They do not have the wherewithal to stand up—

Mr. CULBERSON. Okay.

Ms. SULLIVAN [continuing]. Separate parallel lines. The important thing to do in our view is to move out with this budget and establish the Polar follow-on program because it is that. It is breaking out of this one-at-a-time procurement cycle and moving towards a more economically effective multiple satellite purchase that will

prevent us from kicking this gap further down the road and having the same problem at JPSS-2 and ever thereafter.

Mr. CULBERSON. Thank you.

Mr. Fattah.

Mr. FATTAH. I think it was Dr. Harris, Bernard Harris who wrote the book *Dream Walker*, and it talks about walking in space. And he said that when you are out there and you are facing earth, it is warmer. And when you are facing away, it is colder.

I hope you know it is warm in here. When you are here, we want to help you do what you want to do and what you need to do on behalf of the country.

And the work of NOAA, this satellite gap that the chairman raised, as we know, because the committee looked at this early on, this was set in place well before your tenure, well before this Administration came into being. But it is a problem that we have to help solve.

And as you say that the best-case scenario is for the life of the existing satellite to move as well as it can within the probabilities of some type of failure, catastrophic or otherwise, until the new satellite can launch, but in terms of going forward in terms of not being—I guess there are two sides of this.

One is the satellite repair, you know, the need for funding, and we funded this in NASA, some effort to start to look at how we can extend lives of existing satellites, because we got a lot of satellites floating around out there.

But also your point is correctly taken which is that one of the things the committee can do even as we look at this in the rearview mirror, this gap that none of us had anything to do with, is to make sure that we do not repeat the same mistake and that we forward fund and take the necessary steps to make sure that—because these satellites are critical to our weather.

And as I understand when we talk about severe weather events, these billion dollar plus events, our ability to project where these incidents are going to take place has improved dramatically and, therefore, our warning systems in terms of moving people, we have saved lives and also because we know more about what is going to happen, we are in just a much better position. So it is a worthwhile investment.

And I know that the committee did some work in terms of tsunami warning systems and maybe you could talk to us about where we are with the investments that we have made there and whether there is any additional work we need to do in that trade space.

Ms. SULLIVAN. Thank you, Mr. Fattah.

We have made great strides forward in weather forecast capability. Earlier this year, we were able to step up the operational super-computing capacity times three and sharpen the resolution of our models from 13 kilometers to three kilometers.

You know, if you are Craig Fugate or a county emergency manager, that boils down to now being able to give you a projection of where the key severe weather and storms are going to be that is down to the street and block level, not to just the city level. Tremendous step forward.

On tsunamis, what we have been able to do most recently—

Mr. FATTAH. I would love the chairman to hear this.

Ms. HERRERA BEUTLER. I am sorry. That is me.

Mr. FATTAH. It is okay.

It is important that you just make sure you get this so the chairman can hear.

Ms. SULLIVAN. Thank you.

I had commented we have stepped our operational super-computing capacity—

Mr. CULBERSON. Up three times.

Ms. SULLIVAN. Up three times and that is what our model was, resolution, get down to storm scale, so we are pinpointing a storm in a neighborhood, not roughly a storm somewhere over your city. That is a tremendous improvement for emergency management folks.

Mr. CULBERSON. And the resolution has probably gotten better, too, because you are able to use—

Ms. SULLIVAN. From 13 kilometers to three kilometers, but that is about the computer power that lets us put a finer grid cell into the model. That has been a huge step forward.

That model when we ran it in parallel with the derecho a couple of years ago, we had a ten-hour warning on the derecho which is what led us to get the emergency management—

Mr. CULBERSON. How do you pronounce it?

Ms. SULLIVAN. Derecho.

Mr. CULBERSON. Interesting. Okay.

Ms. SULLIVAN. Mrs. Herrera Beutler will correct my pronunciation if I am off.

Mr. CULBERSON. Well, as a linguist, you know, I figured—

Ms. SULLIVAN. Well, yeah.

Mr. CULBERSON. You got it right.

Ms. SULLIVAN. With respect to tsunami warnings, one of our key concerns there had been the buoy. We have buoys on the deep sea floor of the Pacific and Indian and Atlantic oceans that measure the tsunami when the tsunami is about a half an inch high in the middle of the ocean. This sensor on the sea floor 15,000 feet below can detect it and help us triangulate where it is going and how it is going to develop.

And they are far away out in the middle of the ocean and they are in deep water. It takes very specially equipped ships to be able to service them. And their in-service rate had fallen off because of declines in ship time due largely to the fuel price increases. We have been able to get that tsunami buoy network back up to its 80 percent operational target, so—

Mr. CULBERSON. On the west coast?

Ms. SULLIVAN. Throughout the entire system.

Mr. CULBERSON. Eighty percent?

Ms. SULLIVAN. Yeah, 80 percent. So, you know, that has been a real success. And we have both our Anchorage and our Hawaii forecast centers that model the whole globe. You have to model the whole globe to do tsunami forecasting, the entire global ocean. That can be done anywhere. We do it in Anchorage and we do it in Hawaii.

The Hawaii center is linked to the International Tsunami Warning Center so that our international partners like the Indonesians or the Indians, the Malaysians collaborate and they take the warn-

ings and propagate them through their emergency system to protect their citizens.

Mr. FATTAH. Thank you very much.

Thank you, Mr. Chairman.

Mr. CULBERSON. Thank you very much.

Mr. Jolly.

Mr. JOLLY. Thank you, Mr. Chairman.

I apologize. I am going to bore you with Snapper.

Dr. Sullivan, thank you.

Mr. CULBERSON. We are interested in Snapper in Texas as well.

Mr. JOLLY. Thank you for being here.

I am going to be very honest. I need your help, your leadership on the Snapper issue. The past several years have been incredibly controversial and it is going to get so much more controversial tomorrow with the publication of the new rule.

I understand that balancing the fish stock, balancing the accountability of commercial for hire and recreational. Some Members choose to go all in with one sector. I do not. The first thing I did when I got elected was I put together a council in my district which includes NMFS, NOAA, and other agencies, as you know, of all three sectors to try to figure out where the sectors could actually agree we needed improvement.

And the one area hands down every single sector agrees on is data. Nobody believes the data. Nobody believes the data. Magnuson requires the use of best science in determination closures. We have seen Snapper go from 75 days to nine days and I am pretty sure after tomorrow's rule publication will go to six days, but nobody believes the data behind the rules.

And so as these rules are published and create such controversy, it is the underlying data behind that that if we can improve the data collection and we can meet the requirements of Magnuson, if you can then justify those closures and the stakeholders believe the data, okay, that is fine. But there is such suspicion about the data that it creates the controversy behind the rules.

And so my question for you is on your view of how we are achieving best science, how are you achieving best science ahead of any rule decisions determining closures to comply with Magnuson?

Mr. CULBERSON. And could you talk about the rule itself that they are going to publish tomorrow?

Mr. JOLLY. So tomorrow's rule, well, perhaps if you want to explain the rule, it essentially is going to reduce, you are going to create a buffer zone to reduce the quota number or data number on what you allow for days by 20 percent to ensure there is no overage. So essentially you are taking what had been a hundred percent pool and reducing it to 80 to determine closures which is part of the concern of recreational.

Mr. CULBERSON. And based on what data which is a really important question also when it comes to—

Mr. JOLLY. Sure.

Mr. CULBERSON [continuing]. Weather data for global warming.

Mr. JOLLY. And I will also share, and it is an acknowledgment of the challenge you face, it is easy to get compliance and accountability from commercial because of the way it is regulated. It is slightly easier with for-hire, recreational it is very difficult to deter-

mine their accountability. The challenge it creates, though, is in musical chairs when the music stops, recreational are the last people standing and they have no ability for redress.

So how are you complying with Magnuson's requirement of best science?

Ms. SULLIVAN. It is a complex issue and a complex question, but as you note, it is a very important one and a very challenging one in particular in the Gulf. Just as a backdrop, although it is counterintuitive, part of what we are dealing with here is a cognitive dissonance that comes from the success that actually has been achieved in the Gulf in actually rebuilding the stock. There are more snapper and they are larger and they are being seen now in places where they have not been seen for decades. And all of that is thanks to the discipline and the self-sacrifice of constituents, including the recreational fisher—

Mr. JOLLY. If I may, though, that creates a circular argument. And I have had this conversation, because if you declare the success of the past management plan because now we have more snapper than ever, why are the days going down?

Ms. SULLIVAN. Well, yes. So there is where the apparent inconsistency comes in. And the catch limits for snapper are set on weight and so, when you get bigger fish, fewer fish total up to that weight sooner. And that has had this sort of ironic and counter-intuitive consequence of shortening the number of days, because the weight quota is met faster with the bigger fish. I completely sympathize with the sort of clash that creates for your folks down in the Gulf.

Mr. CULBERSON. And in Texas. I am keenly interested in this question. So do not be constrained, Mr. Jolly, by that—

Mr. JOLLY. I have got a solution for you—

Mr. CULBERSON. Yes.

Mr. JOLLY. Okay.

Ms. SULLIVAN. I know it goes all across around the Gulf states.

Mr. CULBERSON. And you are going to hear about salmon from the West Coast.

Ms. SULLIVAN. I suspected that might be the case.

With respect to data, and our Southeast region is actually a good example of this, we have completely open data calls. Anybody, any party can bring data, and it is everyone adjudicates and debates which data meet the quality standards that the council has agreed must be met for anybody's data to be accepted. If one of my guys brings a study in that does not meet those standards, it does not get included in the data that will go into the assessment.

So we do use outside data, we rely on it quite a lot.

Mr. JOLLY. Well, you make the call for data, but I can tell you those who try to participate feel as though they really do not have a seat at the table, that it is not considered.

Mr. CULBERSON. Is the whole process transparent and is the data out there for independent verification?

Ms. SULLIVAN. It is, yes.

Mr. JOLLY. So let me ask you a question and I realize the time is up.

Mr. CULBERSON. This is important.

Mr. JOLLY. Let me ask you your opinion on a model that has come out of my council. And understand, the council includes all sectors. We have had representatives from your agency, from NMFS, from state regulators sit at the table as well with us to brainstorm on things. Staying out of the controversy of days and catch shares, if the issue is data, that everybody agrees on, everybody is suspicious of, they feel like they do not have a seat at the table, they can submit proposals, they get rejected, how about this model.

The agency currently has cooperative research institutes. What if under the jurisdiction of NMFS, so within the jurisdiction and control of your agency, there was a cooperative research institute that existed with personnel, as well as funding to let out competitively awarded, peer-reviewed research contracts? So that rather than making the decision when the data is presented, you are actually making the decision on proposals submitted by third-party data collectors. It could be major research universities, it could be commercial fishermen who have a GPS, iPhone data system that works, it could be recreational. One, it would bring them to the table. It would be their opportunity to participate and, if they chose not to, well, then shame on them.

But to have a cooperative research institute under Mr. Crabtree's jurisdiction to let out competitive contracts to research universities, recreational angler groups, commercial, and others that met peer-reviewed processes, let out the contracts. That information then is owned by NMFS and we know has to then be incorporated, because they have approved the manner in which it is being collected. Would that be a way to satisfy the——

Ms. SULLIVAN. We do fund, we do fund. And I know Mr. Crabtree, I can get the statistics for you and give you a more detailed briefing. That is the purpose of NMFS's cooperative research. We do not have to establish and pay the overhead of having an institute per se, because the cooperative research budget lines that we have within NMFS are intended to do exactly that. I would be happy to get the detailed data on how much cooperative research is being done associated with snapper across the Gulf.

Whoever does that cooperative research and whoever collects those data on the back end, the data have to pass a peer review to be accepted. So, I mean, my guys could go out and do a bad job on a cruise too. We do not want their data going in——

Mr. JOLLY. Sure.

Ms. SULLIVAN [continuing]. Un-quality checked.

Mr. CULBERSON. So you like Mr. Jolly's proposal?

Ms. SULLIVAN. I would prefer to not put extra overhead expenses in this setting up an institute per se with all the administrivia that might come along with that.

Mr. CULBERSON. But you like his idea?

Ms. SULLIVAN. But I would like to bring back the data on what cooperative research is actually currently being done with respect to snapper in the Gulf. I do not know those figures, I do not know the dollar values or the participants.

Mr. JOLLY. And being incorporated into the closure decisions.

Ms. SULLIVAN. It is certainly worth looking at.

Mr. JOLLY. Because——

Ms. SULLIVAN. That is exactly the——

Mr. JOLLY. Because here is the other thing I think we would accomplish with that. We would eliminate the suspicion by the sector participants, particularly recreational, who believe today—and I know you know this, but I live it—they do not believe that they have a seat at the table. They believe they see more fish than they have ever seen before, and they see a constant reduction annually of the days they are allowed to fish and it does not make sense. And the more people I hear from the agency who say our plan is working, again, then I ask the question, are you declaring success? Because if you are declaring success, then tomorrow's rule is not necessary.

And so there are more fish than ever and yet our recreational guys—and listen, this means something in communities on quality of life of course, but it also means things for our economy. This is a very fragile economic model and it is destructive to the quality of life to coastal communities.

And so I started by saying I need your help and I mean that to set a tone that I am not beating up on the agency, but I am telling you what is being implemented right now is broken. And I have tried to find a solution that is—we have gotten to this cooperative research institute idea. And I will be honest, I appreciate that you have said there is cooperative research going on. From this committee's perspective and from compliance with Magnuson, unless you can demonstrate the teeth behind that and our ability to provide accountability and oversight of the third-party data that is including everybody, I still would want to push for something that establishes a cooperative research institute that we know is accountable.

So, Dr. Sullivan, I appreciate very much your willingness to engage in this conversation.

Ms. SULLIVAN. Very much willing to follow up with you, Mr. Jolly.

Mr. JOLLY. Thank you.

Mr. CULBERSON. And I would like to offer, maybe we can sit down together and have a follow-up meeting on this, because it is a keen interest to me as well and in Texas. And Washington State and the west coast have got similar concerns that are maybe not identical, but they have also got some real serious concerns about fisheries, because it is so important to their economy as well. So I will indulge you guys next.

Mr. FATTAH. Well, there are a few fishermen and women in the New England area too. I know there is a lot of interest in these catch share things.

Mr. CULBERSON. Right, that is right.

Mr. FATTAH. So we would be glad to participate.

Mr. CULBERSON. In fact, water quality has improved so much around the Gulf Coast. We are seeing porpoises and improvements in stocks in areas, like you said, we have not seen them before.

Data collection is so vital, to make sure the data is accurate. I cannot find in your submitted statement, I heard you say that this is the warmest year on record. Where is that and what are you referring to?

Ms. SULLIVAN. Those are the global atmospheric temperatures.

Mr. CULBERSON. Is that in your summary—I cannot figure out where it is—is that something that you added?

Ms. SULLIVAN. I would have to page through my written testimony, that was in my oral statements.

Mr. CULBERSON. Okay. The data has to be accurate. I mean, that is the most important thing. As long as we have got good data, that is something we can all work with. And I think that is one of the biggest concerns, whether it be with the climate or with fisheries or with anything else that we do. Whether it comes to the National Science Foundation, NASA, or NOAA, we just need good data to make good decisions. We have got to be certain the data is accurate.

So I concur completely. And we ran a little over, but that is okay. And when it comes to salmon and the west coast, you guys can do the same thing. So Mr. Kilmer.

Mr. FATTAH. Well, the issue there is whether you are going with the natural hatcheries or—and you have got a lot going on up there in Washington State.

Mr. CULBERSON. Right. Thank you.

Mr. KILMER. Thank you, Mr. Chairman. And thank you, Dr. Sullivan.

I do want to talk about salmon, but I want to start on coastal resiliency issues. I represent a district with a whole ton of coastline and, as a consequence, we are challenged by everything from storms to tsunamis to you name it. And in fact I have got three tribes in our district that are in the process of trying to move to higher ground because of persistent challenges.

In fiscal year 2015, NOAA received an additional \$5 million to expand its regional coastal resilience grants programs. And I just want to get a sense of, one, do you have a sense of when the details of that funding opportunity are going to be made public? And to what extent will the state coastal zone management programs be engaged as part of that effort?

And then in addition, it seems like a lot of the funding is primarily targeted at capacity building and planning. Are we doing enough to actually provide resources on the ground to these communities, you know, that currently lack the capacity to actually address if there is going to be a massive storm or a tsunami or what-not?

And then I will just also throw in while I am asking you questions, how do you see that work being done through this proposal complementing the existing resiliency work being done by the Integrated Ocean Observing System and the Sea Grant Programs?

Ms. SULLIVAN. Thank you for those questions.

Mr. KILMER. You bet.

Ms. SULLIVAN. I do not have the exact date at my fingertips of when we will have that FFO out. I know it is in final stages, so I do expect it very shortly. And the regional ocean partnerships, the coastal zone programs, all I think could be competitive under the terms that I think will be the final terms of it. But it is soon and we will be happy to get back to you when we have got the exact date on that.

Your next question was about the capacity and, you know, I have really seen that vividly as I have traveled around. I was in Hobo-

ken on the second anniversary of Sandy, talking with the mayor there about what are they doing, how are they trying to get up on the curve of the kind of challenges they have there where they can get flooded from every side and up through the ground.

I have been down in New Orleans and met with that city's mayor and resilience manager. And just a couple weeks ago stopped by New York to talk with both the Bloomberg and the Rockefeller foundations that are also trying to move some of their financial capacity and expertise out to do just what you say. To help communities build the capacity within their municipal governments to do smarter planning, to be more aware of the vulnerabilities they have, to have the kind of information tools, which again start with data and start with sound maps.

And key to those maps along the coastal zones are of course the coastal bathymetry, a solid and accurate bathymetry, water level data, the kind of data that NOAA provides from our coastal intelligence arena.

The scale of the need is huge and I cannot begin to say that we are doing enough yet to really meet what we hear and see from communities as demand within NOAA. Our budget request this year has a couple of asks in it that reflect that. A couple million dollars to provide an AmeriCorps kind of service capacity out in the field to get out to those communities and help them begin to start up their own efforts. An expansion of the regional coastal resilience grants from five, which was barely enough to begin taking the lessons learned and practices from the Sandy area out beyond New York, New Jersey, to 45. And uses we would intend with these funds are right on the points that we heard loud and clear from the state and local and tribal leaders who came together in the President's task force in the wake of Sandy.

The whole Federal family wanted to be sure that we were not talking to ourselves about what the needs are and what the real gaps in their capability are, but we actually heard from them about what do you most need from the Federal Government to help you. And when it comes to NOAA, what they most need are the kind of environmental intelligence data that we provide that have very simple first-order tools that are sort of their starting set tools, and that bit of technical support that lets them begin to develop the fluency and the competency they need to take those tools and go forward and plan and work within their community.

Mr. KILMER. I want to make sure to ask about some of the salmon recovery efforts and I know Ms. Herrera Beutler will also be chiming in on this.

I wanted to raise two concerns, one about the \$3 million cut to the salmon management activities account and the targeted Mitchell Act hatcheries in particular. I think if you talk to folks on the ground in our neck of the woods they would disagree with the assessment that that level of funding would enable to meet NOAA's obligation. And I do not understand and perhaps you can speak to it, how do we actually improve our hatcheries and ensure species recovery when we are moving backwards in terms of funding?

And then in addition, when Secretary Pritzker spoke in front of the committee, I asked her about the ongoing challenges facing our hatcheries, which need approved Hatchery Genetic Management

Plans, HGMPs, to ensure compliance under the Endangered Species Act. And she said that they were increasing staff from two to six. And I certainly appreciate that, but we have got a backlog of a hundred HGMPs that have been submitted for review and approval. We have already seen some hatcheries that are operating without sufficient HGMPs be subject to litigation and even get shut down. And that affects our tribes and it affects the recovery efforts and it affects our fisheries.

So how long does it take to review and approve one individual HGMP and is there any estimate to how long it is going to take with six staff to complete this backlog?

Ms. SULLIVAN. We do really appreciate this question and we very much understand your concerns about the Mitchell Act hatcheries. They are a mainstay of salmon and tribal treaty rights in the Columbia River, and we appreciate the points you are making about the economy. We have requested level funding for these hatcheries for many years and we do believe that that level of funding meets our basic obligations.

We appreciate the data on the ground. Folks see more need and more interest. But I assure you we are committed to working closely with your partners on the ground, but the level that we request we are confident does satisfy our basic obligations.

With respect to the genetic plans, we are going to increase our staff and redirect resources to go from two to six. My understanding is that that should let us clear 40 genetic plans, so we could get through that backlog within a couple of years. But it is part of a larger picture. If you look at our endangered species consultation, our genetic management plan consultations, our essential fish habitat consultations, the fact of the matter is that our staff levels are very woefully shy of what it would take to really move any of those forward in a timely fashion.

On our Southeast region, for example, we have a total of 15 staff that are facing a backlog of 550 permanent actions on which we are responsible for endangered species and fish habitat consultation. That is a tremendous strain and a morale drain on my team, which I care about. But more importantly, that makes those permits an impediment to viable and valid economic activity in that region.

And so that is why you will see in this budget request a request for increased consultative capacity, because we are trying to get ourselves out of precisely these backlog holes that you are referring to.

Mr. KILMER. It is a really big deal.

Ms. SULLIVAN. It is a big deal.

Mr. KILMER. Thank you. Thank you, Mr. Chairman.

Mr. CULBERSON. I recognize the young lady from Washington State.

Ms. HERRERA BEUTLER. You know, I was going to start with sea lions, but I will kind of piggyback off of the Mitchell Act, because I have asked about HGMPs as well. And you talked about level funding, but NOAA requests a decrease of \$3 million in the salmon management activities account and those reductions target Mitchell Act hatcheries. So that is not level funding, that is a reduction. And even under level funding, we know that the number of fish re-

leased is decreasing as costs escalate. Moreover, the funding is needed to ensure these hatcheries are maintained.

Just this last week, an estimated 200,000 coho salmon fry died in my district at the Kalama Falls Hatchery in Cowlitz County after a generator pump failed. And I am not sure of the age of the pump, but it is very reflective of deferred maintenance action and aging infrastructure on our Mitchell Act facilities due to funding shortfalls. So 200,000 coho fry is a big deal.

And despite all this, you know, I have asked this question, I think the gentleman from Washington has also asked this question. NOAA states in their budget document they are able to meet their obligation for operation and maintenance, and that their obligation will be fulfilled with regard to hatcheries. I am really hoping this is not the beginning, but the reason we raise it is we are very, very concerned. I would expect you to ask for an increase if that is the biggest issue, but instead you are asking for a decrease.

Ms. SULLIVAN. Well, I think if you look at the President's budget request over the years those, my understanding is, have been level at the level we are asking for this year. I think the Congress has supplemented that from year to year. But I would be happy to go back and look at that figure and look at the trends and get you the detailed information.

Ms. HERRERA BEUTLER. Well, I mean, we have put obviously more money into some of the salmon recovery activities. Even before I was on the subcommittee, just on the full committee, we worked really hard with the Pacific Coastal Salmon Recovery Fund and were able to restore funding there. But we need it to be your priority as well, I guess.

Switching over, I wanted to show—this is what I got the Chairman in trouble for—I was trying to show him something that I would love to show everyone. We can pass it around, there is only a couple of us, but I wanted to make sure you saw it.

Those are sea lions and seals. That is the mouth of the Columbia River on February 15th. This goes to my ports up and down the Columbia. Between just the mouth and the Port of Portland, so that obviously does not go all the way inland, there are an estimated 7,000 sea lions and seals, and they are gorging on our salmon that we spend a lot of money, time and heartache trying to protect because it is important to us. Any kind of dock they will sit on.

A couple years ago there was about six or seven of them that had died and it was when—and I am going to lead into this—the immediate assumption in the paper was that someone had like, you know, passionate tribesmen or recreational fishers had killed them. What later we found out was they engorged themselves and they died.

Mr. CULBERSON. Overate.

Ms. HERRERA BEUTLER. Yeah, on salmon. I do not know if you have ever fished in the Columbia River, but it is really discouraging to commercial, recreational fishers when you get one on the line and only the head comes up. Or you see prehistoric sturgeon lying along the banks with one bite taken out of the middle.

I mean, it is a real problem, which is why I introduced the Endangered Salmon and Fisheries Predation Prevention Act. And it

allows for an increased take, lethal removal of some of these animals. At most, it would be 92 a year. You are looking at about 7,000. So we are not in any way going to harm the population.

But I guess I wanted to know if NOAA has a prediction on how big these populations have grown? Have you determined the size of the population on the Columbia River system and what it could support? And is there an adequate sea lion population size?

Ms. SULLIVAN. I do not have those detailed figures at my fingertips, Mrs. Herrera Beutler. The broad trend is clear and your images show it very graphically of a tremendous recovery over the past three decades. I would be happy to go double check with our NMFS folks and get a briefing brought up to you, bring it myself, if you would like, on exactly what the population numbers are and if they have got an equilibrium population estimate based on what we see happening with the ocean conditions off the northwest coast.

Ms. HERRERA BEUTLER. I would be happy to have that. What I am most interested in, so part of the reason we had to introduce this bill, is right now the agencies do have the authority to lethally remove some of these animals and we do not feel like it is happening quickly enough. The tribes agree, the commercial and recreational fishers agree, the community agrees, and even a lot of conservationists agree that we are losing an endangered population because of what seems like an in-historic or un-historic population of sea lions, that we need your help.

Mr. CULBERSON. So in people's memory, they have never seen this many sea lions before.

Ms. HERRERA BEUTLER. No. And we used to get amazing salmon runs. Our efforts, our recovery efforts are working. We are seeing record runs of all different types. That is why we want to continue the hatchery programs, it is all working. The spill we do over the dams, the mitigation, it is working. But now we have attracted these animals from California and they just sit there and gorge. It is a real problem.

Mr. CULBERSON. Why are they washing up on beaches in California starving to death?

Ms. HERRERA BEUTLER. Well, I don't know. They are talking to each other, apparently, and they are saying, hey, the Pacific Northwest is an entree for endangered salmon, come have your fill. Yeah.

So with that, I do look forward to your help on this. This is something that is not going to go away.

Ms. SULLIVAN. I am glad to do that.

Ms. HERRERA BEUTLER. Thank you.

Mr. CULBERSON. Mrs. Roby.

Mrs. ROBY. Thank you, Mr. Chairman. Thank you for being here today.

As you know, all regions of our country, from blizzards in the Midwest to earthquakes on the west coast and hurricanes in the southern and eastern United States, our country has to be mindful and prepared for when weather-related disasters do unfortunately occur. And without forecasts and models and up-to-date predictions on the timing and strength of these natural disasters, Americans would be completely caught off guard. So I want to thank you for

all you do for our nation's citizens, for the safety and infrastructure and natural landscapes.

Hurricanes and all that are packed along with them, high winds, possible flooding, the usual spinoff, tornadoes are one of the most severe weather-related disasters that my constituents in Alabama's Second Congressional District have to be mindful of during the summer and fall months. So if you can share with me the results and major findings of the first successful launch of the unmanned aircraft system directly into the eye of the hurricane last year, if you could talk about that a little bit.

And then my follow-up question to that is, do you feel that this should be repeated? And, if so, does the budget—do you request money to do so in this year's budget?

So if you could just talk about that a little bit and how it has had a positive impact.

Ms. SULLIVAN. Thank you for that question, Mrs. Roby.

Data from actual measurements of the conditions inside a hurricane are very critical to the accuracy of track forecasting. And on a research front, as you know very well, we have had much better success scientifically improving track forecasts over the last couple decades. The error cones are much narrower now than they were 20 years ago.

Getting the intensity right and getting shifts in intensity, jumps in intensity, has been a much more challenging problem. The science has not cracked that nut yet. Data measurements inside active storms are key to both of those. That is why we operate the two P-3 aircraft that we do that have tail Doppler radar and other instruments that can fly at various levels right through the heart of the storm at different points in time to characterize it.

The experiment we did with the—I have just lost the name of the little vehicle—anyway, the small unmanned aircraft that we deployed out of a sonobuoy tube. Its wings pop out and it navigated itself down through the storm. So a sonobuoy we dropped out before just plummets, basically, right straight down through. What we were interested in with this device is it has some capability to navigate and actually fly around, not just fall straight through, and how might that help us better characterize the lower couple of thousand feet of the storm.

Our P-3s do not fly below, I think it is 3,000 feet, it might be 4, but for obvious safety reasons there is an altitude they stay at or above. And the lowest level of the storm, where you have got all the friction with the ocean and the picking up of the moisture, the transfer of energy from the ocean to the hurricane, that is clearly a pretty critical part of the storm and it is impossible to sample it.

We have done two experiments in the last couple years. One is we took a self-propelled ocean glider, which we are also experimenting with, the kind of unmanned systems we are doing small-scale pilots with to see how they might help improve our mission. And two seasons ago we had one of them move in sort of a picket line underneath a storm, so we could get some measurements as the storm went over it. They move really slow, you have got to put them out or put enough of them out that the storm goes over some of them. So that is a bit of a logistics challenge. In this case, drop-

ping this little device through and letting it fly around a bit, it survived down to the sea surface, it did get us some very low-level winds.

And that is the snapshot summary that I have. I would be happy to get our research teams to come up and give you some more information on that, if you would like.

First experiments can be intriguing. We of course need to do a couple more runs and then we could really understand how many of these would it take to make a meaningful data contribution. What do the prices and the operations really come up to all in cost? Does it prove to be cost efficient or not? So I would say right now both the ocean glider and the small UAV are in the tantalizing—not even yet in the promising stage, but in the tantalizing stage. And we will continue to work on a pilot scale through the next hurricane season or so.

Mrs. ROBY. Okay. And just real quick, I see the yellow light. Shifting gears to tornadoes, which also is something that we deal with quite frequently in Alabama every year and have unfortunately had some pretty devastating tornadoes in recent history that we have lost a lot of life. So it is a big deal. And in the last year's appropriation bill you were provided with funding to collaborate with the National Science Foundation and it said, quote, "to initiate a project to understand how environmental factors that are characteristic of the southeastern United States affect the formation, intensity and storm path of tornadoes in the region."

In this year's budget request, my understanding is that you have asked to terminate this and it is Vortex Southeast Project. And I can take it for the record, but I just want to know more specifics about did that project ever really begin and why are you terminating it, and what assurances can you provide this committee that you guys are going to continue to really study tornadoes in the southeast part of our country.

Ms. SULLIVAN. Let me commit to come back up and give you a full briefing on that and the whole array of things that we are doing centered on tornado forecasting. I assure you, it remains a front-and-center focus of ours given the hazards and the loss of life that you have reflected.

Mrs. ROBY. Okay. Thank you.

Mr. Chairman, I am sorry, I went over. I yield back.

Mr. CULBERSON. You only went over a little bit, thank you, that is fine. I want to ask a little bit about the Polar Satellite Follow-On because you have requested \$380 million in new funding for this. And the out year budgets for this program are substantial, growing to nearly \$600 million in two years. If you could describe for us what the funding would buy in terms of risk reduction, robustness for the Joint Polar Satellite System, and then the, earlier you mentioned efficiencies, I believe, in acquiring systems simultaneously. Talk to us a little bit more about that, if you could?

Ms. SULLIVAN. Certainly. As you may recall we had an independent review team come by about a year and a half ago now, Tom Young and Tom Warman, real established experts in large satellite procurement, and do a very rigorous assessment of the Joint Polar Satellite System. They had been tracking it as it came out of the NPOESS era and they wire brushed us really properly,

but also thoroughly, over the fact that we were buying these systems in about as dumb a way as you possibly could. You would buy one, you would do all the design and engineering, you would get all the supply chain spun up, produce one, and say thank you very much and let that all decay back. And then a few years later you go, oh, I meant I needed another one. And you would incur all of those expenses again. And it is exactly the wrong way to buy any large complex system, but certainly satellites.

They also worked with us to better understand how we needed to wrap our head around not just the gap, but the robustness that is what gets you out of having a gap.

Mr. CULBERSON. So NOAA is actually designing and building the spacecraft, overseeing the design and construction of the spacecraft?

Ms. SULLIVAN. NOAA holds the observing requirements and the budget authority for the spacecraft and we work hand in glove with NASA to actually do the development and execution of the design. There is no need to duplicate the satellite acquisition expertise that NASA has. So we rely on them as the acquisition agent.

Mr. CULBERSON. Okay. So NASA is actually the lead on this?

Ms. SULLIVAN. NOAA is the lead; NASA is our acquisition partner.

Mr. CULBERSON. Okay.

Ms. SULLIVAN. So the Polar Follow-On, we looked at the JPSS-1 and -2 program, which is the current program of record as established. We looked at the timing that we had managed to set for that based on our gap mitigation efforts and scrubbing that all to the left. And then we looked at the existing spacecraft, the structure that you are going to bolt the instruments onto, and the instrument contracts and said how much, how quickly could we get to robustness? Robustness means the satellite system we depend upon for our weather forecasts can tolerate one failure and still support weather forecasting and you could restore its capacity within about a year. That is the typical space architecture definition of robustness. And your greatest risk of losing that is when you are launching a satellite because that is the highest risk moment in the life of a satellite. So a robust architecture has the next satellite in sequence ready right close to a launch date—

Mr. CULBERSON. Sure.

Ms. SULLIVAN [continuing]. To cover that big risk. You do not actually launch it right then, you launch it when you are getting towards the outer edge of the age. But you separate your production cadence from your launch cadence. And the PFO program is the best path we could craft to move to that kind of an approach. Number one, it establishes congressional authorization for satellites beyond the JPSS-2 satellite. And if you look at the lead time it takes to build our instruments, if we do not start right about now on those next two spacecraft we will be repeating the prospect of a big gap—

Mr. CULBERSON. Right.

Ms. SULLIVAN [continuing]. As we are looking at now.

Mr. CULBERSON. I want to dive into this more with you in separate meetings—

Ms. SULLIVAN. Okay.

Mr. CULBERSON [continuing]. Because I understand you are working hand in glove with NASA but I want to understand more about how that process works. Because it seems to me logically you ought to just let NASA build the spacecraft for you and NOAA obviously be the customer and provide funding. But NASA—

Ms. SULLIVAN. And that—

Mr. CULBERSON [continuing]. Does a pretty good, NASA does a pretty good job.

Ms. SULLIVAN. They do a very good job. In this particular mission, Mr. Chairman, where there is such tight integration from the satellite specifics to the actual model input and the model architecture, that vertical alignment of responsibility and the ability to look end to end, from engineering decisions you might make on the satellite to implications for a very large and complex national modeling architecture on which the weather forecast accuracy critically depends, that, that end to end mission alignment in this case makes very, very good sense.

Mr. CULBERSON. What is the Earth Observing Nanosatellite-Microwave instrument, and is that critical to weather forecasting? It, is obviously brand new, does that introduce any unnecessary risk? And what process did you go through to determine it was an appropriate investment?

Ms. SULLIVAN. That EON-Microwave plays a couple of roles. It opens a pathway at fairly low expense towards what could be a smaller, lighter, less expensive microwave sounder. The two instruments that the weather forecast system depends on critically, both are called sounders. They make profiles of temperature and moisture in the atmosphere, they just work in different portions of the spectrum. The microwave one is the all weather workhorse. So this conceivably could take the microwave sounder of today and make it much smaller and more complex. It comes out of Lincoln Laboratories and our systems engineering folks consulting with NASA and other partners as we were scouting the horizon for what might be new architectures we should be thinking of for down the road, noted that, evaluated it highly. So it gets us two things. If it proves out, it could be an avenue towards less expensive, good, competent microwave sounders. And secondly, it is on a time path with Lincoln Labs that it could also play a significant role as a gap mitigating effort in its own right. We are talking with NASA about co-investing in that because it is an interesting observing technology from their point of view as well.

Mr. CULBERSON. Thank you. Mr. Fattah.

Mr. FATTAH. To go closer to your own work, in part, earlier in your career, one of the budget items is something around \$150 million for a new vessel. Can you talk to us about the import of this and what it would be used for?

Ms. SULLIVAN. It is a very high priority for us this year. NOAA currently has a fleet of 16 ships. In oceanographic ships you can easily think of them as basically small, medium, and large based on how close to shore and how long offshore their mission requires them to stay. So if you are going out in the middle of the Pacific Ocean to work on those tsunami buoys, you need a fairly large vessel with a big deck and heavy winches, and the ability to stay out at sea a long time. If you are doing coastal nearshore fisheries

work, you can work with a much smaller vessel. We spent a good amount of effort these last couple of years looking very critically at the age of our current fleet. Vessels at sea have to be certified to operate under various maritime rating authorities or they have to be retired. We have laid up seven, I think it is seven ships since about 2003. So we are losing ship capacity now.

When we stack up the observations, the scientific observing requirements that all of our different missions drive, we already do not have a fleet anywhere near substantial enough to meet those which is why we rely so much on charter and other partners. But the important point is as we looked downstream and said where are we going to be down the road, given the time it takes to procure a ship? We, half of our current ships will have aged out and be offline, laid up, or tied up alongside, or turned into razor blades by 2028. That is not very far down the road. And the group that is going to age out first is our mid- to ocean-class vessels because they are the oldest in the line. So that is what drives the timing of this ask, is to prevent that erosion of the fleet in the 2028 time frame. This class of ship is driven and our request is driven by where we are going to have the gap first.

And the other factor involved here is we propose to use an existing Navy design. And NAVSEA, the procurement arm for Navy ships, has a production line for this class of vessel still open. If we can seize this opportunity now we can save the taxpayers something on the order of \$10 million, actually probably a higher number because if you delay and have to refresh the design and rehire the folks and restart the production line, that number probably goes higher than ten by the time you are all done. So again, as, you know, as with our space systems, we are not DARPA, we are not the cutting edge systems guys. We don't try to be the first movers on big cutting edge systems. We try to parlay into existing acquisitions and systems and programs in the interest of cost efficiency whenever we can.

Mr. FATTAH. One other question. The other budget item is a \$3 million increase, this is a partnership in part with Brazil and the Air Force on a radio oscillation weather satellite.

Ms. SULLIVAN. COSMIC, radio occultation, in Taiwan.

Mr. FATTAH. Yes, COSMIC-2, yes. Yes, I am sorry.

Ms. SULLIVAN. That is all right. There is an existing U.S.-Taiwan partnership that has a set of sensors in orbit now called COSMIC-1. And this is actually a very clever technique that was developed that observed that as GPS satellites send all their time signals back and forth to each other, the signal bends a little bit on its path from satellite to satellite based on the physical properties of the atmosphere. And you get some smarter scientists and clever mathematicians together and they figured out how to extract from that bending angle information about moisture and temperature in the atmosphere, essentially a sounding. This sounding method cannot penetrate all the levels of the atmosphere that our normal sounders do, it cannot fully replace true vertical soundings. But it does provide a helpful correction. It has improved the quality of the forecast by stripping out biases in the other data. It ranks very highly when you stack up all the different kinds of data that con-

tribute to the accuracy of weather forecasts. It is in the, it is in the top, certainly in the top ten.

So we are requesting \$3 million to continue with COSMIC-2. The current system is beyond its design life. It has proven its value. We would like to replace that system with COSMIC-2 and continue to retrieve those sounders.

Mr. FATTAH. Mr. Chairman, let me just put on the record that you provide a lot of services but you do not, unlike some of our economic competitors we do not charge for these services, weather services, other information that's provided to the private sector, companies like AccuWeather, and to benefit you know all of our T.V. stations and others benefit from this service that is provided through the National Weather Service. And you also provide navigation information to, for navigation of the seas, and so on. Do you, in terms of the work that you do, there is a lot of benefit to the American, to American enterprise. If you could just spend a minute just talking about how NOAA has an impact on our economy? I guess is the way I would phrase it, generally.

Ms. SULLIVAN. Thank you for that opportunity, Mr. Fattah. Yes, the model here is one that considers the, let me called it the foundational data, I mean, vertical profiles of the atmosphere, fundamental measurements of the ocean bottom, to treat those foundational data as public goods. And so anybody, a college student, a kid with a cool idea for an app, AccuWeather, The Weather Company, anybody can get at those data without any barrier to entry and capitalize on them as they see fit. So the data become a tremendously powerful open innovation platform. You are well aware of the scale of the private sector weather enterprise, because with this model by design NOAA stops at the foundational data. We do not try to be the spiffy guys that read the news, read the weather to you on T.V., or compete with the private sector for apps and advanced analytics. So, you know, The Weather Company when it was sold to GE went for about \$4 billion, Climate Corporation, which is based on public good USDA and NOAA data, when it sold to Monsanto was sold for \$1 billion. Our electronic chart data when I was at NOAA as the Chief Scientist, we printed the charts on gigantic printing presses in the basement of the main Commerce Building. Nowadays we just send the data raw from the ship, quality control, and then out to third party companies that do the, they package it into an electronic chart display, if you are going out to sea. They, all of your Garmin systems, if you are using offshore nav, they are using the NOAA data or they will publish you the chart book if you prefer to have the hard copy or want to have the backup. So the notion of, the notion of foundational data about the planet as public goods, that make sure that public safety never becomes a fee for service proposition but is always a fundamental assurance of government, and that serve as this really vibrant, open-ended—

Mr. FATTAH. Yes, Mr. Chairman, I am not arguing that we change it. I just wanted to make sure that we make the point, that it is different from, say, you know, Germany, or other countries, where this information is sold.

Ms. SULLIVAN. Or where the government service takes roles that the private sector here takes.

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

Mr. CULBERSON. Very quick question, Mr. Jolly.

Mr. JOLLY. No real additional questions, other than I recalled sitting here an invitation, a letter I sent to you last year extending an invitation for the research vessel Nancy Foster to at least temporarily port down at St. Petersburg Bay. We have a cluster there, a marine science research cluster there from USF Marine Sciences to NMFS, to Fish and Wildlife, to the U.S. Coast Guard Stanford Research Institute. It is a center of excellence in marine and weather science research and they would welcome with open arms at least a temporary port of call from the Nancy Foster if you were to find interest or an ability to do so.

Ms. SULLIVAN. One of the joys of my life is how popular my ships are.

Mr. JOLLY. I bet. I bet.

Ms. SULLIVAN. In communities around the shoreline. But I do know that welcome mat is out, and it is a very, very impressive cluster of expertise.

Mr. JOLLY. Very good. I appreciate it. Thank you.

Mr. CULBERSON. Thank you. Why not contract out more of this work? I am not a big traveler. One of the few trips I have ever taken has been out to go see Dr. Ballard, on the Nautilus. They do extraordinary work.

Ms. SULLIVAN. They do.

Mr. CULBERSON. And the private sector is, I think the universities around the country would leap at the chance if NOAA was a customer and was offering to, I know Texas A&M, for example, has a wonderful oceanographic research vessel. Why not contract out more of this work, rather than invest in purchasing new ships which can be tremendously expensive and costly to maintain? When, I am just a big believer in the yellow pages test.

Ms. SULLIVAN. Yes.

Mr. CULBERSON. If you can find a service in the yellow pages that the government does, we should contract it out as much as we possibly can to provide better service at a better price for the taxpayers.

Ms. SULLIVAN. We currently contract out 50 percent of our charting, and about 50 percent of our fisheries research. I can get you the precise figures. And even about a third of our Tower A Deep Sea, which is the, you know, the oddest one because there, I have looked at the yellow pages, not a whole lot of listings for guys that want to go out to 15,000 foot of water and haul up buoys. So we, those are the roughly current percentages in those sectors now, and as I am sure you know our ocean exploration program co-funds Dr. Ballard's vessel. When—

Mr. CULBERSON. With great success, very—

Ms. SULLIVAN. With great success. And when we put the evaluation together that led us to bring the ocean survey vessel request forward to you here, we did that side by side with the NSF folks who fund the ships and support the ships such as the ones at A&M and with the Coast Guard to make sure that we were not asking for an asset or a capacity that already is out there.

The reality is if you look at, if you look at the National Science Foundation's proposal pressure, the scientific demands for ocean

going research that they face as well as the scientific demands that we face, those combined far exceed their ships plus our ships plus everything else. So the demand remains much larger than either the federal civilian oceanographic fleet or the NOAA fleet or both of them combined——

Mr. CULBERSON. Well, the existing fleet. I just wondered whether you have, because I had the same question of NSF. Years ago I remember the Bush administration tried to transfer the responsibility for building and maintaining the ships that go to the Antarctic to the National Science Foundation from the Coast Guard. NSF has got enough on their plate. So I fought hard to get that out of NSF. So I had the same question of the NSF.

Ms. SULLIVAN. Yes.

Mr. CULBERSON. If the money was out there and you were proposing to do this, have you ever looked at, looking forward, encouraging the private sector if there is a pot of money out there, we are willing to be a customer, there is X amount of money available. Have you seen any interest from the private sector or universities to——

Ms. SULLIVAN. Well we have seen it in those areas where we have a good constant need, because that is a stable enough demand function——

Mr. CULBERSON. Right.

Ms. SULLIVAN [continuing]. That they can look at it. And that is why we are up to 50 percent, slightly north of 50 percent, on both our mapping and charting and our, and our fisheries research vessels.

Mr. CULBERSON. And the buoy, the maintenance of the tsunami detection system, you said you are up to about 80 percent, and that is with NOAA vessels?

Ms. SULLIVAN. That is the in service, the data availability is at 80 percent. The TOGA TAO buoys that give us the El Nino seasonal outlooks, we do about a third of that maintenance work with private sector vessels. We do, I do not know the percentage but I could check into it for you, we have made international partnerships with other nations that benefit from the tsunami network to draw them into servicing buoys that are closer to their waters so that we are not bearing the cost of those long transits.

Mr. CULBERSON. I will follow up with you on that. But I will also be following up on you, I am very concerned about the report that came out in November that hackers from Communist China had breached the computer systems at NOAA and essentially the report was in AP that four of your Web sites were compromised by an internet source, attacked. And my predecessor, Chairman Wolf, discovered that the attack originated in China and came only a couple of days after the Communist Chinese had also hacked into the U.S. Postal Service computers and, U.S. Postal Service's computers and compromised information from some of its customers and employees. How long was NOAA's system down? I understood they actually took over control of some of NOAA's weather satellites. And could you talk to us a little bit more about what happened?

Ms. SULLIVAN. They certainly did not take over control of our weather satellites. I do not know where that misinformation may have come from.

Mr. CULBERSON. Okay.

Ms. SULLIVAN. They did compromise some of our Web sites and it took us several days, I would have to get you the details and we will bring you a full briefing on that.

Mr. CULBERSON. Okay.

Ms. SULLIVAN. Some of the information is sensitive because of threat information and things like that but——

Mr. CULBERSON. We will sit down and visit about it. I know Mr. Fattah is concerned about this, we all are concerned about it as well.

Ms. SULLIVAN. We will be happy to bring you a report on that.

Mr. CULBERSON. And I also want to visit with you about the report that, let us see, when is this? This is Inspector General Report 1425A that talks about the risks posed by the inconsistent implementation of mobile device protections increases the likelihood of malware infection. I want to go through some of that with you as well.

Ms. SULLIVAN. Sure.

Mr. CULBERSON. Because cyber is so important, and it is of keen interest not just to NOAA but obviously throughout the federal government. And it continues to look like the Chinese have been particularly bad actors in this area and we want to make sure that we are doing all we can to help protect you.

Ms. SULLIVAN. It is a dynamic and challenging threat environment and we would be happy to visit with you further on that. It is a priority of mine, as it is of the Secretary's and the President's.

Mr. CULBERSON. I deeply appreciate your service to the country. I will also be following up with you on making sure that the data is accurate in terms of making sure—where, I still cannot find in your testimony where you said this is the warmest year on record. Warmest year on record where?

Ms. SULLIVAN. It was in my oral statement and we can get you those statistics. The global——

Mr. CULBERSON. I mean——

Ms. SULLIVAN [continuing]. The global atmospheric average.

Mr. CULBERSON. It was the warmest year on record throughout the entire planet, or in the United States, or where?

Ms. SULLIVAN. Average across the globe——

Mr. CULBERSON. Average across the globe.

Ms. SULLIVAN [continuing]. Atmospheric temperature.

Mr. CULBERSON. Okay. I am keenly interested in following up with that because as Mr. Jolly pointed out we just want to make sure we get accurate data. And I was alarmed to see that there was, there has been in a lot of documentation that estimates, that weather data has been estimated or extrapolated and averaged up. I just want to make sure we have got accurate data to make good decisions. I do appreciate your service to the country and we look forward to following up with you on these and other matters, and we will submit any additional questions for the record. Thank you very much.

Ms. SULLIVAN. Thank you, Mr. Chairman.

Mr. CULBERSON. And the hearing is adjourned. Thank you.

The Honorable Robert B. Aderholt
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on the National Oceanic and Atmospheric Administration
FY 2016 Budget Request

1. **The evidence is clear that the expensive global climate modeling effort supported in your budget has yet to reproduce the actual observations of the deep atmosphere of the last 3+ decades. This is the part of the atmosphere that is most affected by greenhouse gases so it needs to be done correctly. Are you willing to support independent research for those unaffiliated and even critical of the modeling industry to investigate these shortcomings on behalf of the American people? If you believe you have already done so, please provide a comprehensive list of grants awarded in the last five fiscal years which fit that description. This is vital because tens of thousands of jobs are being lost based on model projections shown here which to anyone's eye are invalidated by real observations.**

Response:

NOAA supports independent evaluation of and further research through its climate modeling results. The agency makes data from its model simulations available and accessible on the internet (<http://nomads.gfdl.noaa.gov/>). This data access facilitates independent analyses, including comparison of model simulations with observations. Publishing the results of model simulations in peer-reviewed journals is also an important aspect of scientific verification. NOAA scientists publish extensively on the results of their modeling studies in leading peer-reviewed scientific journals. Further, NOAA's climate model simulations are submitted to the World Climate Research Program's Coupled Model Intercomparison Projects (CMIP), which represents a worldwide, transparent exercise involving analyses of the model simulations, leading to hundreds of peer-reviewed papers by independent scientists. Independent assessments of NOAA's climate models routinely report that they are among the best performing in the world.

As part of the research occurring by the climate community on models and other aspects of climate research, NOAA administers competitive grant programs that are open to anyone in the federal and extramural community, including the private sector. Through Federal Funding Opportunities (FFO), NOAA invites the community to submit proposals that address topics covered in the various solicitations. Proposals are peer-reviewed based on their scientific merit, qualifications of the investigators and budget. NOAA welcomes ideas backed by scientific knowledge, appropriate methods, and show promise for new understanding. Eligibility criteria for applicants and the review process are published as part of the FFO. The FFO and all grants undergo legal review before they are finalized.

2. **The FY15 House Report encouraged NOAA to conduct research (Vortex III) in the Southeastern United States. Not to do the research in the Midwest and share the information with the Southeast. As we all know, the conditions, variables, topography, humidity are all different in the Southeast. With the expertise and extensive infrastructure that is already in place at universities such as UAH, why has NOAA ignored this language and continued to conduct all the research in the Midwest?**

Response:

NOAA received \$5.45 million in FY 2015 to initiate VORTEX-SE to understand how environmental factors that are characteristic of the southeastern United States affect the formation, intensity, and storm path of tornadoes for this region. NOAA plans to work with various academic partners, including University of Alabama at Huntsville, and the National Science Foundation to conduct an experiment in the southeast United States. The experiment is designed to produce tangible scientific and technological accomplishments and will consist of a combination of (1) acquisition and deployment of a small number of critical ground-based remote sensing systems (profilers, radars, lidars, etc.) to better understand the key characteristics of the environment of tornadic storms in the southeast United States; (2) conducting “baseline” studies to determine current gaps in observing, understanding, and predicting tornadoes and communicating critical information to the public; and (3) developing targeted state-of-the-art numerical weather prediction systems to address the specific nature and predictability of storms in the southeast region.

WEDNESDAY, MARCH 4, 2015.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WITNESS

**CHARLES F. BOLDEN, ADMINISTRATOR, NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION**

CHAIRMAN'S OPENING REMARKS

Mr. CULBERSON. The Appropriations Subcommittee on Commerce, Justice, and Science will come to order.

Before we begin, I wonder if I could take a moment, General Bolden, to recognize and thank Mike Ringler who has been our chief clerk on the committee for many, many years and a Rock of Gibraltar for all of us.

It has been a real privilege, Mike, for us to work with you, for me to work with you. You have taught us all so much and we are going to miss you. And you have served the country and this committee so well. We are really genuinely going to miss you and I wish you all the best.

Thank you for everything you have done for the country and the Congress and this committee. I really mean it. Thank you. Thank you. We are going to miss you.

Mr. FATTAH. And if the chairman would yield——

Mr. CULBERSON. Yes.

Mr. FATTAH [continuing]. Let me also add that it has been an absolute pleasure to work with you and we have gotten a lot done together and helped a great many people. So thank you and we wish you well. I understand you found a perfect place in a perfect state to pursue further career activities. Thank you.

Mr. CULBERSON. Back to Pennsylvania as soon as he could.

Mr. SERRANO. Mr. Chairman, I also want to add my words.

Mike, you have been a real gentleman and fair, and to me, that word is very, very important, fair, balanced. Unlike a TV station, you have really been balanced. And I appreciate that and I wish you all the best. And, you know, we keep losing good people and other people keep gaining good people. And so good luck, and am I supposed to say go Yankees or that upsets you?

Mr. RINGLER. Go Pirates.

Mr. SERRANO. Okay. Congratulations.

Mr. RINGLER. Thanks very much.

Mr. CULBERSON. Today is also significant because it is Bob Bonner's 20th, I believe, anniversary of helping with the minority staff.

Mr. FATTAH. Congratulations.

Mr. CULBERSON. And it is a real tribute to both of you guys.

Mr. SERRANO. And I think it is important that you singled him out also because he is going to have a long suffering season with the Phillies, so, you know, it is going to be very painful for Bob.

Mr. CULBERSON. Well, we have always had a bipartisan bill and tremendous cooperation and support on the committee. It is a tribute to both of you guys and the great work that you have done, but also it is a real privilege for us all to work together on such noble, good causes as NASA and law enforcement and scientific research and keeping the United States at the cutting edge. It is something all of us on this subcommittee share a passion for and you guys have been essential to its success and we really appreciate it.

In fact, when I was asked to serve on the Appropriations Committee back in December of 2002 going into my second term, I was at a dinner with Tom DeLay who was my neighbor to the south. He was becoming majority leader. He said I will give up my seat on appropriations if you will take it.

And I was reluctant. I do not like to spend money if I can avoid it. I said unless it is science or NASA or National Defense, the answer is probably no. And he said you are hired. It has been a great assignment. I asked to serve on this subcommittee so that I could be here to help the National Science Foundation and NASA.

So it is a genuine privilege and something I want to, you know, thank the people in my district in Texas and the Members of this committee. It is just a privilege to be here to serve as chairman, to follow in Frank Wolf's footsteps who has done so much for so many years to help NASA and the scientific community.

Frank was a real mentor to me and it is an extraordinary privilege for me to serve as chairman and to have you here today, General Bolden. You are a true American hero, great inspiration I know to a lot of young people all over the country. You are a role model for young people I know all over the country.

We all admire you immensely. Just deeply appreciate your service to the country and the marine corps, as an astronaut and the administrator for NASA. We admire you immensely, sir, and it is just a real privilege for me to be here today, for all of us to be here to help you achieve your mission of making sure the United States maintains its leadership in the world as the best space program, manned and unmanned on the planet.

The President's budget is asking for \$18.5 billion for NASA which is an increase of \$519 million above the current fiscal year. And we have a very difficult budget environment, as you know, sir, but there is strong support of this subcommittee for your mission.

We want to make sure that you have the resources you need and the freedom that you need and support to do what is on your plate. You have got a lot on your plate and never seem to have enough resources. It is an ongoing problem.

In this particularly difficult budget environment, we have also got to make sure we are fully funding the FBI, the other Federal law enforcement programs. We have got, of course, the Department of Commerce, the National Science Foundation, NIST, and adequately funding all of these programs and others within this budget environment is going to be very, very challenging.

We do not yet know how the House budget is going to shape up, but we can feel pretty confident that the President's budget rec-

ommendation is one that we are simply not going to be able to achieve because it assumes a lot of tax increases which certainly are not going to happen.

But I know from my work on this subcommittee that you are going to find all of us arm in arm in making sure that NASA gets the support that you need, sir, to do your job.

We will be using the timer today to make sure, if we could, that everyone is recognized in a timely fashion. And I would be privileged at this time to recognize my good friend, Chaka Fattah, for any comments he would like to make.

RANKING MEMBER OPENING REMARKS

Mr. FATTAH. Thank you, Mr. Chairman, and to the administrator.

The chairman is absolutely correct about the inspiration you provide. I know you made a visit to Philadelphia to Overbrook High School which graduated one of your great astronauts, Guion Bluford, and you spoke with the students there and, you know, I am sure even to this day is an inspiration to all there in the Overbrook community.

Now, I was just out at the Jet Propulsion Laboratory, my second visit. I was there a while back with you when the Mars rover landed after eight and a half months of travel. We were on the control room floor and there was such a celebration because it showed again that the premier entity in the world in terms of space exploration and flight is NASA and to land the rover there.

And I got a chance to see in my last visit two weeks ago or so, you know, some of the work that is still being done on a daily basis at the Jet Propulsion Laboratory. And I know that NASA's most valuable control assets are in Texas, but you do have a little operation in Florida and in California.

So I did get a chance to visit with your national headquarters staff here also and I have learned so much about what is going on. And there have been some miscues, I think, in some notion when we retired the shuttle fleet that somehow America was out of the business of leading in space. The truth is that we still lead in space.

And you have some active missions that are going on right now and I would hope that as part of your testimony, you could just share a minute or two about what NASA is doing right now in space because as we deal with the numbers, sometimes we lose a sense of what this is really all about and our exploration of space, our development of space.

And yesterday I got a chance to spend some time with the Commercial Spaceflight Federation for their board meeting and their dinner last night. So I know you had another celebration of very significant import into the work that you have been engaged in.

So we welcome you to the committee. We want to hear about your proposed budget and we want to work with you. And the chairman, there could not be a more committed person, I think, in the Congress to the success of NASA. We have had many conversations and I think you have a true advocate. We are going to work together to create a bipartisan product that can help NASA continue to achieve.

Thank you.

Mr. CULBERSON. General Bolden, we welcome your testimony. Your entire statement, of course, will be entered into the record without objection and we welcome your testimony, sir. And, again, thank you for your service to the country.

ADMINISTRATOR'S OPENING REMARKS

General BOLDEN. Well, Mr. Chairman, thank you very much. I want to just take a quick moment to echo everyone's sentiments to Mike Ringler. I am glad you broke the ice because I did not want to say anything and spill the beans if nobody knew it. But it has been a great pleasure working with Mike and we are going to miss him.

So, Mike, best of luck from all of us at NASA.

I want to congratulate you, Mr. Chairman, also on becoming the chairman of this committee because I do know through the years of our conversations how much it means to you and how serious you are about the duties of this committee. So I think we are very fortunate to have you in that position. I also thank you, as I mentioned earlier, for your recent visits to several of our facilities out on the West Coast and look forward to hosting you out there some more.

Mr. Chairman, to you and the Members of the subcommittee, the President is proposing, as you mentioned, a fiscal year 2016 budget of \$18.5 billion for NASA that builds on the 2015 appropriation and the significant investments the Administration and the Congress have made in America's space program over the past six years.

Thanks to the hard work of our NASA team and partners all across America, we have made a lot of progress on our journey to Mars. In fact, we have gotten farther on this path to sending humans to Mars than at any point in NASA's history. And this budget will keep us moving forward.

The support of this subcommittee and the Congress are essential to this journey. The International Space Station (ISS) is the critical first step in this work. It is our springboard to the rest of the solar system and we are committed to extending space station operations to at least 2024. Thanks to the grit, determination, and American ingenuity, we have returned ISS cargo resupply missions to the United States, insourcing these jobs and creating a new private market in low earth orbit.

Under a plan outlined by the Administration early in its term, we have also awarded two American companies, SpaceX and Boeing, fixed price contracts to safely and cost effectively transport our astronauts to the International Space Station from U.S. soil. This will end our sole reliance on Russia. It is critical that we receive the funding requested for 2016 so that we can meet our 2017 target date and stop writing checks to the Russian Space Agency.

Our newest, most powerful rocket ever developed, the Space Launch System (SLS) has moved from formulation to development, something no other exploration class vehicle has achieved since the agency built the space shuttle.

The Orion spacecraft performed flawlessly on its first flight to space this past December. The SLS and Exploration Ground Systems (EGS) are on track for launch capability readiness by Novem-

ber of 2018 and the teams are hard at work on completing the technical and design reviews for Orion.

Our budget also funds a robust science program with dozens of operating missions studying our solar system and universe. New Horizons is preparing for its arrival at Pluto in July and Dawn is now approaching the dwarf planet Ceres.

Before we send humans to Mars, robots are paving the way. We are at work on a Mars rover for 2020 and have begun planning a mission to explore Jupiter's fascinating moon, Europa.

NASA is a leader in Earth science and our constantly expanding view of our planet from space is helping us better understand and prepare for these changes. NASA has 21 research missions studying Earth. In the last year alone, we launched an unprecedented five more. We also are at work on humanity's first voyage to our home star, a mission that will repeatedly pass through the sun's outer atmosphere.

NASA's Hubble, Chandra and Kepler space telescopes explore the universe beyond our solar system. Hubble's successor, the James Webb Space Telescope (JWST), is taking shape right now out in Maryland and a new mission is in development to extend Kepler's pioneering work in finding planets.

Technology drives science, exploration, and our journey to Mars. With the President's request, NASA will continue to maintain a steady pipeline of technology to ensure that we continue to lead the world in space exploration and scientific discovery.

NASA is also with you when you fly and we are committed to transforming aviation particularly as we just celebrated the 100th anniversary of the NACA last night at the National Air and Space Museum. But we intend to dramatically reduce the environmental impact, maintain safety in more crowded skies, and pave the way toward a revolutionary aircraft shapes and propulsion systems.

Mr. Chairman, America's space program is not just alive. It is thriving. The strong support we receive from this subcommittee is making that happen. I particularly appreciate the generous fiscal year 2015 appropriation.

As the President said in his state of the union address, and I quote, "We are pushing out into the solar system not just to visit but to stay, part of a re-energized space program that will send American astronauts to Mars," unquote.

NASA looks forward to working with the Congress to make this vision a reality. I would be pleased to respond to your questions.

INSPECTOR GENERAL OR GAO RECOMMENDATIONS

Mr. CULBERSON. General Bolden, thank you.

Before I go into some specific areas, we started our hearing schedule this year with the inspectors general because they always do a good job of identifying inefficiencies and ways to save money and particularly in light of the tough budget environment we are going to be facing this year and how everyone on this subcommittee, as I said earlier, are strong supporters of NASA.

I miss having our friend, Adam Schiff, here. He is now the ranking member on the Intelligence Committee. And I know he is here in spirit and will certainly be working with us to help support the recommendations of this subcommittee for NASA.

But if you could, talk to us a minute about any specific example where NASA has implemented Inspector General or GAO recommendations to save money or create efficiencies.

General BOLDEN. Sir, I would be very glad to do so. Since the Inspector General's report and also thanks to this committee, I think everyone knows that we contracted for a study by NAPA which was done last year. They gave us 27 recommendations with reference to Foreign National Access Management (FNAM). We took all of those recommendations to heart and are well on the way to complying with them.

We have made structural changes in our governance at the Agency and we see through our construction of facilities program that our buildings are becoming leaner, and I mean that in terms of the acronym for energy efficient. We now have LEED buildings across the Nation that is showing that we are trying to save money through our facilities as we reduce our footprint and in the place of excessive infrastructure replace it with very efficient buildings.

If you talk more about governance, the Chief Information Officer (CIO) and many of the other critical people in positions at NASA headquarters now report directly to me, so they are my direct reports. So in that manner, we are streamlining the way that we conduct project management.

I would point out that over the past six years since I have been the NASA administrator, we are very proud to say that most programs have come in on cost and on schedule which in the past was somewhat rare. So I think that the results that we have seen in the last six years say that we have taken everything to heart from the IG and from this committee.

OTHER COST SAVING MEASURES

Mr. CULBERSON. Other than reducing the property footprint and streamlining project management, what other steps have you taken to implement, for example, cost saving measures that were recommended either by GAO or the Inspector General?

General BOLDEN. We have done a number of efforts and I would take it for the record to bring you a compilation——

Mr. CULBERSON. Okay.

General BOLDEN [continuing]. Of the things that we have done. But I just tried to give you a few of those——

Mr. CULBERSON. Okay.

General BOLDEN [continuing]. Top line efforts.
[The information follows:]

Inspector General or GAO Recommendations**Human Exploration and Space Operations****OIG Report: “Extending the Operational Life of the International Space Station Until 2024” (IG-14-031)**

Recommendation 1: The NASA Associate Administrator for the Human Exploration and Operations Mission Directorate continue to solicit commitments from international partners to improve cost sharing.

Management’s Response: NASA concurred with the recommendation and outlined plans to formally address the recommendations through ISS control boards, a key practice that ensures the longest utilization period for the ISS.

Status/Estimated Completion Date: Recommendation is open with planned action on-going. Estimated completed date is to be determined.

In January 2014, the Administration and NASA announced the extension of the operations and utilization of the International Space Station (ISS) until at least 2024. This extension enables NASA to make progress towards the goals of the ISS: extending human spaceflight beyond low-Earth orbit (LEO); enabling the development of the commercial market in LEO; conducting research to benefit humanity in areas such as medicine, physical and life sciences, and earth and space sciences; and providing the basis for exploration international partnerships. The ISS International Partners are expected to address extension in the next couple of years. This will allow sufficient time for each partner to determine their unique level of participation in the ISS program and exploration. NASA has partnered with the Center for the Advancement of Science in Space (CASIS) to advance the development of the commercial market in LEO through development activities across private industry including pharmaceuticals, material sciences, biomedicine, and earth science. CASIS continues to expand its development activities to fully utilize the research and application capabilities provided by the ISS.

NASA and its International Partners have conducted extensive operational and maintenance analyses to determine the appropriate level of spares, maintenance cycles, and logistics necessary to maintain the ISS on-orbit platform to at least 2024. System upgrades needed to operate the ISS to at least 2024, including docking systems and new lithium ion batteries for the electrical power system, are already under development. Larger external equipment and spares, such as the lithium ion batteries, are planned to launch on the Japanese HII Transfer Vehicle (HTV) prior to its retirement. Occasional failures of external hardware are to be expected, and

NASA prepares for these with on-orbit spares and spacewalk preplanning. In response to faster-than-expected degradation of the solar arrays, NASA is assessing a variety of options to improve power generation/balance in the out years. The ISS program is currently in the process of procuring commercial cargo transportation services. Once actual costs for transportation beyond the current Commercial Resupply Services (CRS) contract are known through the procurement process, the ISS will update its budget requests accordingly. Commercial crew development activities are currently underway. Once contracted commercial crew costs are known, these will also be incorporated into the ISS budget request.

OIG Report: “NASA's Management of Commercial Crew Program” (IG-14-001)

Recommendation 2: Examine whether more comprehensive costs estimates should be developed by the Commercial Crew Program before completion of the Critical Design Review.

Management’s Response: NASA concurred with the recommendation. And outlined a plan employing a series of reviews involving both internal and external checks that continually examine the Commercial Crew Program’s (CCP’s) status in the normal course of business.

Status/Estimated Completion Date: The recommendation was closed by the OIG in May 2015, based on NASA’s demonstrated performance of associated reviews.

In September 2014, NASA announced Commercial Crew Transportation Capability (CCtCap) awards to Boeing and SpaceX. The associated Request for Proposal (RFP) required the companies to provide comprehensive, fully integrated plans towards the development of their respective Crew Transportation Systems (CTSs). NASA reviewed these plans, which included detailed cost estimates and schedules along with supporting rationale, during its evaluation and accepted the proposals for Boeing and SpaceX. These companies are now under firm, fixed price contracts for completing the development of their CTSs. NASA concluded the Certification Products Contracts (CPC) with SpaceX, Boeing, and Sierra Nevada. The primary objective of CPC was the deliverables, technical interchange, and NASA disposition of early life-cycle CTS certification products. The purpose of the contract deliverables was to assess the contractor readiness to transition to CCtCap. The final contract deliverables included: 97 alternate standards, 109 variances, 316 hazard reports, and Verification and Validation Plans and Certification Plans for each contractor. In addition, almost 500 background data documents were delivered by the contractors and reviewed by NASA.

Through NASA’s assessment of these deliverables, the Agency was able to give the companies clear and actionable feedback relative to NASA requirements. CPC was an outstanding accomplishment and each company was able to incorporate NASA’s

feedback into their designs going into CCtCap. NASA and the Federal Aviation Administration (FAA) signed a Joint Program Management Plan describing the detailed roles and responsibilities each agency has for the execution of the CCP. In addition, a program-level NASA/FAA working group and Headquarters-level NASA/FAA legal team were established and have been making excellent progress on issues related to NASA astronauts flying on FAA-licensed vehicles. A substantial number of issues associated with NASA requirements and FAA regulations have been closed and action plans exist on closing the remaining issues. For example, the FAA published an interpretation, which addresses the ability of astronauts to perform operational functions during a commercial launch or reentry. The FAA published additional interpretations covering waivers and international partners. In addition, a Launch & Entry Steering Group has been established which is a forum for NASA, the United States Air Force, and the FAA to establish consistent policy regarding crew, range, and public safety. The charter for this group has been signed and an initial meeting has been accomplished.

GAO Report: “Space Launch System: Business Case Needed to Decrease Risk and Support Long Term Affordability” (GAO-14-631)

Recommendation 2: To provide decision makers with an informed basis for making investment decisions regarding the SLS program, NASA should identify a range of possible missions for each future SLS variant that includes cost and schedule estimates and plans for how those possible missions would fit within NASA’s funding profile.

Management Response: NASA concurred with the recommendation and outlined a plan to pursue documented tactical (near-term) and strategic (in preparation for Mars) capabilities for SLS.

Status/Estimated Completion Date: Recommendation is open with planned actions scheduled for completion in December 2015.

Recommendation 4: To promote affordability, before finalizing acquisition plans for future capability variants, NASA should assess the full range of competition opportunities and provide to the Congress the agency’s assessment of the extent to which development and production of future elements of the SLS could be competitively procured.

Management Response: NASA concurred with the recommendation. NASA articulated plans to adhere to all applicable federal and NASA supplemental acquisition regulations, including full justification on any proposed contract action for other than full and open competition.

Status/Estimated Completion Date: Recommendation is open with planned actions scheduled for completion in July 2015.

GAO noted that the program's technical issues were not overly complex, and that management systems were in place to address them. The evolvable nature of SLS (and by extension the other exploration programs) is consistent with procurement best-practices for buying down program risk; likewise, evolvability is a key component of the capability-driven architecture. These exploration programs are designed to enable multi-decade human exploration beyond low-Earth orbit in support of national objectives and policy. The requirements for a safe and reliable human exploration transportation system (particularly in terms of lift capacity and volume) are significantly greater than for non-exploration missions. Taken together, the capability-based framework and the evolvable architecture provides the foundation for a sustainable approach to exploration. From this strategy, NASA has identified conceptual missions that provide defined minimum capabilities for SLS (such as required mass delivered to lunar or Martian orbit), while the basic timing of those missions (operating in cis-lunar space through the 2020s, with missions to the Mars vicinity in the 2030s) drives when upgraded capabilities are required.

The Exploration Systems Development (ESD) Enterprise is aggressively preparing the SLS, Orion Multi-Purpose Crew Vehicle (Orion), and the Exploration Ground Systems (EGS) needed to provide the foundational elements required for Deep Space Exploration. NASA recognizes the challenges of pursuing concurrent development of these three programs and has made substantial progress toward demonstrating these capabilities within the context of a capabilities-driven architecture. ESD has established a proactive affordability initiative that each program has implemented to find ways to avoid the need for greater expenditures in the development phase of the program. This has resulted in tens of millions of dollars in cost avoidance both now and in the future. The fact that we are adapting existing hardware, facilities, and designs in the ESD Enterprise actually reduces the overall need for and cost of design reviews and testing.

OIG Report: "Space Communications and Navigation - NASA's Management of the Space Network" (IG-14-018)

Recommendation 1: Reevaluate the Space Network Ground Segment Sustainment (SGSS) Project for Key Decision Point (KDP) C authority and ensure the Project is funded at the required levels for success. At a minimum: a) require the SGSS Project Office to complete a revised and realistic cost estimate with revised joint confidence levels and evaluate the revised estimates for KDP C success criteria and b) evaluate the results of the revised KDP C estimates and adjust the SGSS Project baseline and Agency baseline commitment as necessary.

Management's Response: NASA concurred with the OIG's recommendation and outlined corrective actions including obtaining a revised cost and schedule estimate, and evaluating it against anticipated budget and program requirements and options to determine a way forward.

Status/Estimated Completion Date: Recommendation is open with planned actions scheduled for completion in July 2015.

Recommendation 4: Examine options to increase funding for the Space Network, including acquiring funds from other less critical priorities within the Agency.

Management's Response: NASA concurred with the OIG's recommendation and established plans to seek other reimbursable customers to reduce the burden on the Agency.

Status/Estimated Completion Date: The recommendation was closed by the OIG in April 2015 based on implementation of their recommendation.

Recommendation 5: Document the cost factors and formulas used for reimbursable rates and ensure those rates are reevaluated and new rates set on an annual basis.

Management's Response: NASA concurred with the OIG's recommendation and articulated an approach to reevaluate reimbursable rates, including annual escalation for inflation.

Status/Estimated Completion Date: The recommendation was closed by the OIG in October 2014 based on implementation of their recommendation.

NASA's Space Communications and Navigation (SCaN) Program was created to integrate Agency-wide space communications and navigation architecture to assure continue efficacy of the Agency's space communication networks. The evolution of the integrated system will take place in phases through the SCaN Network Integrated Project which currently is in pre-phase A. The Near Earth Network, Space Network and Deep Space Network initially will remain independent. In the interim, SCaN is adding new capabilities that extend the functionality of the networks and will be incorporated into the integrated architecture. The SCaN Program has been providing communications, navigation, and delivery of data to space flight missions for over 30 years of uninterrupted service. As the has OIG noted the current satellite communications systems are aging and increasingly difficult to repair, thus SCaN has addressed these challenges through three separate activities that are all underway:

- Adding a new generation of communication satellites (the Tracking and Data Relay Satellites [TDRS] project) to the Space Network fleet;
- Upgrading Space Network ground infrastructure through Space Network Ground Segment Sustainment (SGSS) Project, and;
- Upgrading the deep space communication capability through Deep Space Aperture Enhancement Project (DAEP).

SCaN is focused on developing technology to raise the communication capability to the next plateau, that being optical communication. With the exceptional success of the recently completed Lunar Laser Communication Demonstration project, SCaN is well positioned to continue development toward an optical communication operational capability within a decade

Earth/Space Science

Our scientific missions are inherently complex and present unique challenges, as most represent significant first-of-a kind achievements. But with these challenges, it is increasingly important to execute SMD's missions on time and within budget. In the 2010 Science Plan for NASA's Science Mission Directorate, SMD outlined the Agency's efforts to revise and implement new policies to constrain mission costs and meet schedule goals. These measures include:

- Establishing confidence level-based mission life-cycle budgets
- Obtaining independently generated internal and external cost estimates
- Reviewing projects at multiple, formal Key Decision Points that function as gates to the next stage of development

Additionally, NASA has started requiring the Decadal Survey committees to perform independent cost estimates for their proposed mission concepts. By adhering to these steps over the past six years, NASA has launched many missions within their cost and schedule baselines, demonstrating measurable progress in improving the Agency's mission cost estimation and management tools. This record of cost and schedule performance for SMD is unprecedented.

The Van Allen Probes (formerly known as the Radiation Belt Storm Probes [RBSP]), Juno, Gravity Recovery and Interior Laboratory (GRAIL), Mars Atmosphere and Volatile Evolution (MAVEN) mission, Landsat Data Continuity Mission (LDCM)/Landsat 8, and the Global Precipitation Measurement (GPM) mission were all executed within the original budget commitments made to stakeholders.

GAO Report: "James Webb Space Telescope: Project Meeting Commitments but Current Technical, Cost, and Schedule Challenges Could Affect Continued Progress" GAO-14-72

Recommendation 1: In order to ensure that the JWST project has sufficient available funding to complete its mission and meet its October 2018 launch date and reduce project risk, ensure the JWST project has adequate cost reserves to meet the development needs in each fiscal year, particularly in fiscal year 2014, and report to Congress on steps it is taking to do so.

Management's Response: NASA concurred with GAO's recommendation and reaffirmed the Agency's commitment to assuring sufficient funding levels to support JWST's October 2018 launch date.

Status/Estimated Completion Date: Recommendation is open with planned actions scheduled for completion in December 2015.

Recommendation 2: In order to help ensure that the JWST program and project management has reliable and accurate information that can convey and forecast the impact of potential issues and manage the impacts of changes to the integrated master schedule, perform a schedule risk analysis on OTE, ISIM, and cryocooler schedules, as well as any other subschedules where a schedule risk analysis was not performed. In accordance with schedule best practices, the JWST project should ensure that the risk analyses are performed on reliable schedules.

Management's Response: NASA concurred with GAO's recommendation. NASA performs monthly integrated programmatic and cost/schedule risk assessments to forecast and manage impacts to schedules. This assures the continued viability of the JWST development plan. To further enhance this review process, NASA will perform a probabilistic schedule risk analysis of the JWST OTE, ISIM and cryocooler schedules using schedules that meet NASA best practices, and for other schedules where a risk analysis was not performed, with completion expected by the end of calendar year 2014 for OTE, ISIM, and cryocooler.

Status/Estimated Completion Date: Recommendation is open with planned actions scheduled for completion in December 2015.

In the case of the James Webb Space Telescope (JWST) which was rebaselined in 2011, the GAO stated in its 2014 report, "The James Webb Space Telescope (JWST) project is generally executing to its September 2011 revised cost and schedule baseline...." SMD will continue to rigorously maintain these practices to improve schedule and cost performance. Over the past year the NASA OIG issued several reports and reviews focused on SMD activities, including SOFIA, the NEO program, ICESat-2, and the Mission Extension Process. In the context of these reports SMD has agreed to take corrective actions and appreciates the opportunity to make incremental improvements to its processes and programs.

Information Technology/Information Security

OIG Report: "Audit of NASA's Information Technology Governance" (IG-13-015)

Recommendation 2: Require the Agency CIO approve all IT procurement expenditures over an established threshold. The threshold should capture the majority of IT expenditures regardless of procurement instrument, to give the CIO visibility and authority over all Agency IT assets.

Management's Response: NASA concurred with the OIG's recommendation and established plans, including the issuance of Procurement Notice 04-75, which requires Contracting Officers, in coordination with the Center CIO, to determine whether existing or planned enterprise license agreements can fulfill a software requirement before entering into a new contract or consenting to a subcontract for those software requirements.

Status/Estimated Completion Date: The recommendation is open with completion of associated management actions scheduled for November 2015.

Recommendation 8: In light of the changes recommended in this report, reevaluate the resources of the OCIO to ensure that the Office has the appropriate number of personnel with the appropriate capabilities and skill sets.

Management's Response: NASA concurred with the OIG's recommendation and established a plan to conduct an organizational assessment to identify the resources and skill sets necessary to support the IT governance improvements and expanded responsibilities for the OCIO and Center CIO organizations.

Status/Estimated Completion Date: The recommendation was closed by the OIG in November 2015 based on its review of the implementation of NASA's actions in response to the recommendation.

Continuing to improve Information Technology (IT) governance structure in response to the eight recommendations in the OIG's June 2013 report is an Office of the Chief Information Officer (OCIO) fiscal year 2015 priority. On December 6, 2013, the NASA Chief Information Officer (CIO) presented a Phase 2 IT Governance model decision package to the Mission Support Council (MSC). The MSC approved implementation of Phase 2 of IT Governance, providing the NASA CIO increased visibility into Center Institutional IT investment planning and execution beginning in FY2016. The implementation plan was presented to the MSC in March of 2014 and the NASA CIO participated in Center IT budget formulation activities for FY 2016. The IT governing board structure and charters, as well as Mission Directorate IT representative roles and responsibilities, will be updated as changes to the IT Governance structure are approved, based on findings from the initial FY 2016 formulation activities. In January 2014, the NASA CIO hired an IT Governance Lead to facilitate management and implementation of related NASA IT Governance decisions and actions to help ensure a committed focus on strengthening NASA's IT governance model.

Advancing NASA's IT security posture in response to ever-growing threats and attack vectors remains a priority for the Agency, as demonstrated by increased funding for IT security efforts in FYs 2014-2016. NASA is taking a holistic

approach, through continuous monitoring and mitigation, to network, system and information protection by overcoming barriers to ensure efficient and effective management of the Agency's IT assets. Many of these barriers include malicious software, unauthorized access to Agency's computers, and connectivity to partner organizations. To continue building a more solid IT security framework, NASA completed, or is in the process of implementing, several improvements, such as upgrading our intrusion detection systems. Also in FY 2014, we introduced the first intrusion prevention systems at the NASA Trusted Internet Connection (TIC) location (currently in its final stages of deployment). Additionally, the CIO is working across the Agency to reduce NASA's web footprint presence by eliminating unused and duplicative web applications that increase our attack surface. Finally, we are enhancing our collaboration across Centers\Mission areas and with external organizations. The Agency will continue to take corrective action to address the highest priority IT security needs and recommendations.

Procurement Management

GAO Report: "Acquisition Planning: Opportunities to Build Strong Foundations for Better Services Contracts" (GAO-11-672)

Recommendation 1: To take fuller advantage of important acquisition planning elements and to ensure that information is available for future use, we recommend that the Secretaries of HHS and DHS and the Administrators of NASA and USAID direct their procurement offices to ensure that agency and component guidance clearly define the role of cost estimating and the incorporation of lessons learned in acquisition planning, as well as specific requirements for what should be included in documentation of these elements in the contract file.

Management's Response: NASA concurred with GAO's recommendation. NASA outlined series of activities intended to implement the recommendation including the establishment of structural and procedural methods to capture lessons learned in acquisition planning during Procurement Strategy Meetings (PSMs) and the establishment of Source Evaluation Board (SEB) offices within many NASA centers.

Status/Estimated Completion Date: The recommendation was closed by GAO and reported as such in December 2014 based on their assessment of actions taken in response to the recommendation.

OIG Report: "NASA's Award Closeout Process" (IG-14-014)

Recommendation 1: Standardize the award closeout process across all Centers to include developing and implementing a policy requiring Centers to maximize use of the closeout contractor and establishing a timeframe for procurement staff to turn instruments over to the contractor.

Management's Response: NASA concurred with the OIG's recommendation and developed plans to review the closeout process across all Centers consistent with the OIG's recommendation.

Status/Estimated Completion Date: The recommendation was closed by the OIG in January 2015 based on the actions taken by NASA in response to the recommendation.

OIG Report: "NASA's Strategic Sourcing Program" (IG-14-010)

Recommendation 1: Revise NASA's Strategic Sourcing Plan to: (a) identify and assign specific responsibilities for individuals, groups, or organizations within NASA that manage, administer, and report strategic sourcing efforts; (b) include a methodology for how spend analysis should be developed, analyzed, and used; (c) include a methodology to periodically identify Agency-wide strategic sourcing opportunities using current financial and procurement management information systems; and (d) require the periodic extraction and assessment of Agency-wide, inter-Center, and cross-organizational spending data to ensure the Agency is receiving the best value for products and services.

Management's Response: NASA concurred with the OIG's recommendation and established a mechanism to update its Strategic Sourcing Plan and once updated, include guidance addressing all four elements of the recommendation.

Status/Estimated Completion Date: The recommendation was closed by the OIG in October 2014 based on completion of planned activities and the OIG's review of the actions taken in response to the recommendation.

NASA's Office of Procurement is continuing to strengthen and improve contracting and grants processes throughout the Agency. For example, we have revised the strategic sourcing plan and strategic sourcing governance structure. We have made significant strides in strengthening the contract and grants closeout processes and will be publishing guidance on this subject to establish standards for closeout. We have strengthened training in the award fee process and believe NASA's approach to award fee is sound and compliant with the Federal Acquisition Regulation and statute. Finally, we are undertaking a significant effort to strengthen the management of grants through the implementation of the Office of Management and Budget's (OMB) Uniform Administrative Requirements for Federal Awards, which the OMB intends to publish by the end of the calendar year.

OIG Report: "NASA's Use of Space Act Agreements" (IG-14-020)

Recommendation 3: Establish a close-out process or similar mechanism to track the costs and benefits of non-reimbursable SAAs. At a minimum, the process should capture: (a) overall costs to the Agency, (b) whether the SAA's stated goals or objectives were accomplished, including an assessment of the overall performance of the partner; (c) how the benefits were applied or utilized.

Management's Response: NASA partially concurred with the OIG's recommendation and outlined plans to work with the Agency's partnerships community and stakeholder offices to establish a close-out process for non-reimbursable agreements.

Status/Estimated Completion Date: The recommendation was closed by the OIG in May 2015 based on the actions taken by NASA in response to the OIG's recommendation.

Recommendation 4: Complete and implement the Reimbursable Process Team's recommendations to improve the reimbursable process and correct NASA's current inability to combine financial and nonfinancial information in the Agency's accounting system.

Management's Response: NASA concurred with the OIG's recommendation and created a plan which incorporated already existing efforts to improve reimbursable agreement tracking by developing a reimbursable reporting process.

Status/Estimated Completion Date: The recommendation is currently open with planned actions scheduled for completion in September 2015.

Recommendation 5: Establish policy and procedures to account for the costs of NASA's non-reimbursable SAAs.

Management's Response: Partially concur. NASA's systems are not currently set up to track costs for non-reimbursable activity as proposed by OIG. While these costs are subsumed and managed within overall project budgets, NASA appreciates that there is significant interest in the non-reimbursable activities. Given the complexity and variety of these arrangements, specific data on non-reimbursable activities has not been systematically or consistently captured. Accordingly, NASA will revise its processes for reviewing non-reimbursable arrangements by extending the existing requirement for formal Estimated Price Reports (EPRs) and Center CFO approval to non-reimbursable agreements. Additionally, an annual revalidation of these cost estimates will be required. These improvements will be fully implemented by September 30, 2015.

Status/Estimated Completion Date: The recommendation is currently open with planned actions scheduled for completion in September 2015.

In regard to NASA facilities, NASA maintains the Aerospace Technical Facility Inventory (ATFI). This is a data base which captures technical and other data for NASA's major technical facilities that can be made available to the aerospace industry. NASA has incorporated ATFI into the NASA Engineering Network TOOLS so that it is available to NASA program managers when developing partnering agreements. In addition, NASA expertise is listed on the Federal Laboratory Consortium website, identifying each Center's critical expertise. The Federal Laboratory Consortium facilitates technology transfer and partnerships. As part of NASA's participation in the Lab-to-Market Cross-Agency Priority Goal, NASA posts machine-readable data from the AFTI on Data.gov. This allows external researchers, innovators, and companies to easily find open data on NASA's user facilities.

This topic of increasing awareness of NASA's capabilities, expertise, and facilities for SAA opportunities was also emphasized through training workshops and presentations during NASA's annual Agency-wide *Partnerships Community of Practice* meeting held at NASA Headquarters May 12-14, 2015.

NASA Procedural Requirements (NPR) 8800.15, "Real Estate Management Program," provides guidance on various out-grants but does not specifically clarify when it is appropriate to use SAAs versus other types of lease agreements beyond a discussion of the authorities. The NASA Real Estate Desktop Guide provides guidance regarding the strengths and authorities of many of the types of agreements NASA uses such as reimbursable and non-reimbursable space act agreements, enhanced use lease, concessioners agreements, and commercial space launch agreements. NASA is in the process of updating the Real Estate Desktop Guide, and will strengthen the guidance for the types of agreements NASA uses. The Desktop Guide update is expected to be completed by September 2015.

The NASA Partnership Office of Primary Responsibility within the HQ Mission Support Directorate, in coordination with affected Agency stakeholder offices, developed and implemented a close-out process for domestic and unclassified non-reimbursable SAAs. The close-out process is an automated process, affected via the Agency's Space Act Agreement Maker (SAAM), and went "live" in April 2015 after an extensive roll-out and training effort for Agency users. The closeout process captures for each such agreement whether the SAA's stated goals or objectives were accomplished, how the benefits were applied or utilized, and other pertinent information.

NASA has performed extensive work over the past several years to develop a process that links the Estimated Price Reports (EPR) estimates entered in the Space Act Agreement Maker (SAAM) system (nonfinancial) to information on Sales Orders that show actual agreement amounts. We are now in the process of implementing the capture and reporting of these amounts in our Business Object (BOBJ) reporting Model, which will permit systematized assessment of the estimates. This action will be fully implemented by September 2015.

The Agency Office of Chief Financial Officer (OCFO) along with the Office of General Counsel (OGC) and Mission Support Directorate (MSD) Partnership Office (PO) have disseminated and revised policy to include the requirement for EPRs on non-reimbursable SAAs. During May 2014, both the Agency OCFO and MSD PO issued guidance to the Agreement Managers requiring EPRs with all SAAs, reimbursable and non-reimbursable. The OCFO guidance also included direction to use the existing EPR template in NPR 9090.1 that was updated to reflect the non-reimbursable costs in a collaborative agreement. In August 2014, OGC issued an update to the NASA Advisory Implementing Instruction (NAII) 1050-1, NASA Space Act Agreements Guide, to include the EPR requirement (Section 1.3, The HQs Abstract Review Process). The annual validation of estimated costs is being reviewed and will be implemented by September 2015. The best practices guide is in work and scheduled to be complete by June 2015.

ACCESS TO FOREIGN NATIONALS

Mr. CULBERSON. Terrific. And also I want to be sure to follow up with you on limiting the access of foreign nationals, particularly the Chinese, to NASA flight centers. There is, I think, an ongoing problem with the ability of Chinese nationals that are working at universities on a research project gaining access to flight centers and we want to make sure that that does not continue to happen.

Program management, project management is something Inspector General Paul Martin also talked to us about and has pointed out that there is a—excuse me. He talked specifically about better program management and four major challenges that he identified in his report.

He identified that there was an underestimation of technical complexity and how that impacted cost and risk. Funding stability is, of course, a continuing problem, limited opportunity for program managers, development, and moving people around.

Talk to us a little more, if you could, about the way that NASA has responded to his recommendations on project management.

General BOLDEN. I think what Paul was talking about was past practices where when we estimated cost and we estimated schedule, we were optimistic. When I talked about the fact that over the last six years we have brought in programs and projects on time and on schedule, it speaks to that directly.

We spend more time training our program and project managers with formal training. We now have a formal position that is called the Chief Knowledge Officer at NASA headquarters who takes lessons learned from past programs and projects and that is taught to incoming program and project managers so that they understand the mistakes and the errors of program and project management in the past.

We now have a process that all of our programs go through which formalizes our estimation of cost and schedule. We have set a threshold of 70 percent certainty for cost and schedule as a threshold for us. Since we have done that, I think if you look at our science programs, that is what enabled us to bring things like MAVEN or some of the others in if not under cost, actually on cost. I think that is what Paul was addressing.

CYBERSECURITY

Mr. CULBERSON. He also suggested giving your information technology administrator full responsibility, and I hope that you are following through on that recommendation.

General BOLDEN. Yes, sir. The comment that I made earlier about making the CIO for the Agency a direct report to me, I think that is what Paul was talking about. So the CIO—is that what you are talking about?

Mr. CULBERSON. On cyber because there is a lot of concern about the vulnerability of NASA applications.

General BOLDEN. I understand.

Mr. CULBERSON. You obviously have a very big public footprint, as you should, but all of those applications, all those apps that are out there for people's phones and all the public Web sites open you up to hacking. And he was concerned that your information and

technology director does not have the authority that he needs as in other agencies. That is what I am talking about.

General BOLDEN. And that was the reference that I made to, and you used the term information technology——

Mr. CULBERSON. I may not be using the right——

General BOLDEN [continuing]. That is my Chief Information Officer.

Mr. CULBERSON. Okay.

General BOLDEN. So the Chief Information Officer is a direct report to me, to the administrator, which means——

Mr. CULBERSON. In terms of the scope of his authority, I hope you are taking his recommendation to heart to give that individual more authority.

General BOLDEN. Yes. The fact that he reports to me means that he makes policy for the Agency since I make policy for the Agency. So he has direct responsibility and control over IT infrastructure across the enterprise. So all of the CIOs at the individual centers subsequently report to him.

Mr. CULBERSON. Okay.

General BOLDEN. The only area that we have not done what the IG recommended was incorporating program IT systems under the chief information officer and we are looking at that. But in my opinion right now given what we have and given the funds we have, that might be a bridge too far because what we are talking about would be he would have responsibility for maintaining the Information Technology programs on the International Space Station or on Mars Curiosity or MAVEN. And that is something that I am not sure that any agency of the government has done that yet. We are looking at it. I am not saying we will not do it, but we are not there yet. So we have got a long way to go before we incorporate all of the——

Mr. CULBERSON. Okay.

General BOLDEN [continuing]. Program and project IT infrastructure and assets under the Chief Information Officer.

Mr. CULBERSON. I will follow up with you.

General BOLDEN. But for everything else, he has the hammer.

Mr. CULBERSON. I will follow up with you individually on that.

General BOLDEN. Okay.

PLUTONIUM-238 AVAILABILITY

Mr. CULBERSON. Let me ask about one other, getting into a specific area, and then I want to recognize my good friend, Mr. Fattah, about plutonium production because we want to make sure that you have got the plutonium necessary for future missions.

The budget request is for \$15 million for NASA to pay the Department of Energy to produce a supply of plutonium. And I understand that we are approaching the end of the life span for the machines that actually make the plutonium cakes, whatever they are called, that actually make the pellets, I assume.

Talk to us about that and the availability of plutonium for future missions, in particular the Europa mission and outer planets missions.

General BOLDEN. Mr. Chairman, I will say you make an assumption that I want to not let you make and that is that Europa will be a nuclear powered mission. We are looking at——

Mr. CULBERSON. Still in the design phase?

General BOLDEN. Yes, sir. I just want to make sure that no one in my organization had led you to believe that——

Mr. CULBERSON. No.

General BOLDEN [continuing]. We had made a decision yet——

Mr. CULBERSON. Still in the design phase. It is good to have that option.

General BOLDEN [continuing]. On the power system for Europa.

Mr. CULBERSON. You are going to need that option for deep——

General BOLDEN. Yes.

Mr. CULBERSON [continuing]. Space outer planets?

General BOLDEN. But in answer to your question for all NASA outer planets missions, for Mars 2020 and others that we currently have in our inventory in planning, we will have sufficient plutonium-238 to carry out those missions.

We continue to work with the Department of Energy (DOE) as you mentioned, as you alluded. A problem there on the DOE side is just the facilities and the condition of the facilities. We continue to work at an intermediate management level with the Department of Energy to make sure that the funds that we provide to them will, in fact, partially be used to make sure that the facilities are there so that they can make the plutonium that we need.

They are the producer of plutonium-238. Right now to my knowledge, NASA is the only user of plutonium-238, so it is very important to us that they get it right.

Mr. CULBERSON. If you could, would your folks get us a recommendation on what is necessary to make sure that that machinery is——

General BOLDEN. We will do that, Mr. Chairman.

Mr. CULBERSON [continuing]. Brought up to speed so you have got it for——

General BOLDEN. Yes.

Mr. CULBERSON [continuing]. What I think we will ultimately need, a robust outer planets program?

General BOLDEN. Yes, sir.

Mr. CULBERSON. Let me recognize my good friend, Mr. Fattah.

OAK RIDGE NATIONAL LABORATORY

Mr. FATTAH. Thank you, Mr. Chairman.

So this is follow-up on what the chairman was talking about in terms of plutonium. And this is at Oak Ridge National Lab, the plutonium, the 238 production, right?

General BOLDEN. I will take it for the record——

[The information follows:]

Production of Pu-238 and the Radioisotope Power Systems

NASA is funding two elements of work at the Department of Energy (DOE) relating to the supply of radioisotope power systems and the Pu-238 isotope that powers them:

- DOE is developing the capability to resume domestic production of Pu-238 (via the Plutonium Supply Project), and
- DOE maintains other capabilities to use the existing and newly manufactured Pu-238 in Radioisotope Power Systems (RPS) for NASA missions.

The DOE, on behalf of NASA, is working on the Plutonium Supply Project (PSP) to restart domestic production of Pu-238. The project began in 2011. Plutonium production will occur at Oak Ridge National Laboratory (ORNL), with irradiations being performed at reactors at ORNL and the Idaho National Laboratory (INL). Significant progress is being made on a budget and schedule that meets NASA's anticipated needs. NASA does not currently foresee any impact to missions before 2028 and could ramp up to full production by then if needed.

The number of missions that can be supported with current inventories depends on the power required by the individual missions and the planned power systems. Broadly speaking, the current U.S. inventory can support the Mars 2020 mission and one or more additional future missions, depending on the mission power needs. The new domestic production of Pu-238 will enable additional outer planetary missions to be successfully accomplished.

Producing new Pu-238 heat source material is just one of many critical steps in conducting these missions. Using NASA funds (since FY 2014), the DOE maintains an operational capability of equipment and staff to support the design, development, fabrication and delivery of radioisotope power systems, and to ensure their safety. This Operations and Analysis (O&A) activity primarily involves four DOE national laboratories: ORNL, INL, Los Alamos National Laboratory (LANL) and Sandia National Laboratories.

A key element of the O&A effort is maintenance of equipment, including periodic replacement or upgrade of any that has exceeded its useful life. NASA and DOE have agreed to accelerate one such upgrade project at LANL (a hot press and adjacent furnaces), to support the envisioned timing of NASA mission needs for RPS. This upgrade project is expected to be complete in FY 2017.

Continued support of both the PSP and the full scope of O&A activities is critical to ensuring a robust outer planets program at NASA.

Mr. FATTAH. All right. Yeah.

General BOLDEN [continuing]. To find out exactly where it is done.

Mr. FATTAH. So I think that—

General BOLDEN. I should know, but I do not.

Mr. FATTAH. I have done some work in this space and I think that you are correct that NASA is the only consumer, but it is a commitment on DOE's part to make sure you have what you need.

EXPLORATION SYSTEMS DEVELOPMENT

General BOLDEN. Yes.

Mr. FATTAH. But let me go to the big aspiration here which is flight into deep space, out of lower Earth orbit for humans. And you talked about the great work that is being done now on the launch system and where you are.

There is some sense, and it is only because of your success, that perhaps we can move the timetable and maybe that is not the case, and these are probably people who are not as intimately familiar with the work that you are doing, but if you could comment for a minute on how you see the time line, that would be good.

General BOLDEN. Congressman, I will do my best. The President has set a rough outline for us in demanding that we provide a way to put humans with an asteroid by 2025, but most importantly that we be on Mars or in the Martian system in the 2030s.

And with that direction in mind and bipartisan agreement by the Congress, we have a long-range program in existence today to which we are marching and that calls for several things.

America is still the leader in space and I am glad to hear Members of the committee acknowledge that because it is important for all of us to understand that. There is no close competitor to be quite honest.

But in order for us to stay the leader in space, there are a number of things we have to do and deep space exploration is one of them, but we have to make sure that we have a very robust low earth orbit infrastructure that will be run by American industry eventually or non-government entities so critical to that is the completion of the commercial crew program that we now have scheduled to actually fly in 2017. We have brought about commercial cargo and that has proven to be successful. I think by the end of this year, you will see how resilient it is when Orbital Sciences flies a Cygnus on a vehicle other than their own vehicle. So when you are buying a service and the service provider provides it, even when a part of their system goes away, that talks about resilience.

Mr. FATTAH. I was on the floor of SpaceX out in California looking as they put the Falcon 9 together, and it is amazing that this industry that NASA has spawned is so robust now.

You have Boeing. You have SpaceX, low Earth orbit, the commercial crew. What is in the President's budget is \$1.2, I think, 4, right—

General BOLDEN. Yes, sir.

Mr. FATTAH [continuing]. \$1.24 billion?

General BOLDEN. One digit farther I can go.

EXPLORATION BEYOND EARTH

Mr. FATTAH. Yeah. And is that sufficient to continue to—I know you have some other pieces of that. You have the advanced exploration system at about 231.4 and then you have the opportunity flight program which is another opportunity to seed this industry and I think 15 plus.

So can you talk about whether that is sufficient to do the work that needs to be done in low Earth orbit so that you can focus on—and the committee really likes to talk about going to Mars.

General BOLDEN. Yes, sir.

Mr. FATTAH. Asteroids, you know, is not really, I think, the thing that grabs our attention—

General BOLDEN. That is okay.

Mr. FATTAH [continuing]. In total.

General BOLDEN. That is okay.

Mr. FATTAH. It hits you. Go ahead.

General BOLDEN. That is okay.

Mr. FATTAH. Go ahead, Mr. Administrator, yeah.

General BOLDEN. Congressman Fattah, again, I appreciate your reference to the total picture because that is what is really important. And I talked about commercial crew and cargo. \$1.2 billion that we requested in the 2016 budget for commercial crew is essential if we are to bring in the two providers with their capability to carry crew to orbit by 2017.

The second leg of the stool is actually the International Space Station and that is an area that I need to ensure that we do not shortchange, that we do not look at it as a bank and begin to pull money out of International Space Station operations because when we use it as a bank, usually the first place we go is cargo flights, fewer cargo flights which eventually could put the crew in jeopardy because we are not able to get stuff there.

The third leg that you refer to is SLS and Orion and once we have a robust lower earth orbit environment, then we use SLS and Orion to take us, first of all, back to cislunar space. That is around the moon over the 10-year period of the 20s. So beginning in the earliest part that we can of the 20s, we will put Orion on the SLS and send it to cislunar space for multiple flights and then on to Mars.

So it is the three-legged stool that is absolutely critical that you are talking about.

Mr. FATTAH. The red light is on. The red light is on, but if the chairman would—

Mr. CULBERSON. Go ahead, please.

INTERNATIONAL SPACE STATION—INTERNATIONAL PARTNERS

Mr. FATTAH [continuing]. Yield. I think you got the Russians' attention in some other respects. They took a decision this week to announce that they were joining a decision that you had already made a year or so ago about extending the life and their presence in cooperation relative to the International Space Station.

Could you just share with the committee where we are with all of our international partners now that Russia has made this decision?

General BOLDEN. And I would just caution what you hear coming out of Russia is not always what they intended to say. I am encouraged that they now have, in fact, in their reorganization, because they are going through reorganization just as we are, they now have what is called the Roscosmos Science and Technology Council. So that is a brand new entity that was put in place when they put Roscosmos under the umbrella of their whole space industry organization and it is much more complicated than I want to try to explain to people. We were encouraged when Yuri Koptchev who I consider to be, because he is a former colleague of mine, who I consider—

Mr. FATTAH. You did a mission with him, right?

General BOLDEN. No. This is not the astronaut. This was the former head of the Russian Space Agency, of Roscosmos. It was Mr. Koptchev who actually could be considered the Russian father of the International Space Station because he and a predecessor of mine, Dan Goldin, were the two people who were most responsible for getting the station started, if you will. He is the head of the Roscosmos Science and Technology Council (STC) and it was that council that met and said that it was their position that Russia should remain committed to the International Space Station and that they should remain committed through 2024 before they go off and start talking about taking pieces off and establishing their own lower earth orbit infrastructure. So I think that is what you refer to.

I would say one more thing because you commented about international partners. Everyone should take note of the three space walks that were completed this past week. You know, Butch Wilmore and Terry Virts did three absolutely amazing space walks which in themselves were great.

Mr. FATTAH. Five hours?

General BOLDEN. They were long. Each of them was in the neighborhood of six to eight hours. But what was most important was that that completed the installation of the international docking adapter which it gives the International Space Station now the capability of accepting any vehicle from any partner that wants to bring crew to the International Space Station.

So we are now ready to receive. There may be a few puts and takes we have got to do, but the station is now ready to receive Boeing, SpaceX, any American company that wants to fly a vehicle to the International Space Station.

The international part I wanted to point out for everybody, the intra-vehicle crew member, and I have been one, that is the hardest thing on the whole thing. The intra-vehicle crew member, the person inside choreographing all three space walks was Samantha Cristoforetti who is an Italian astronaut.

So if you do not think that our partners are doing their part and that they are excited about this, that was a true international effort to set up American industry to be able to service the International Space Station with crews, and that was incredible.

Mr. FATTAH. Thank you, Mr. Chairman, for yielding for those additional few seconds.

Mr. CULBERSON. Let me recognize Mr. Jenkins at this time.

INDEPENDENT VERIFICATION AND VALIDATION (IV&V) FACILITY

Mr. JENKINS. Thank you, Mr. Chairman.

Good morning, Mr. Administrator.

General BOLDEN. Good morning.

Mr. JENKINS. I am from down the home of the rocket boys and Homer Hickam, West Virginia. So I would like to spend just my brief minute or two bringing us back to earth a little bit about some of your work and what NASA does and obviously as participating in grant funding and projects in my State of West Virginia.

The chairman brought up the IG's work. I would like to maybe get your take a little bit on the NASA Independent Verification and Validation (IV&V) Facility program up in Fairmont, West Virginia, critically important to our state, your feelings about that program and its value.

General BOLDEN. Independent Verification and Validation (IV&V) Facility has been of critical value to us since its beginnings. It is an asset that we use to do safety assurance evaluations and the like. And there are a number of other things that go on there.

I think the IG, if I remember his comments, you know, some people took it to mean that he was recommending that we get out of IV&V or out of the facility. And that is not something that is, you know, immediately on our plate. As we look at our assets and our capabilities, we are looking at what we should do with each, but IV&V is a critical facility.

Mr. JENKINS. Would you mind sharing, to the extent you are able to or maybe a follow-up, some of the details behind the importance and, as you say, the value propositions that come out of that facility and what we do?

General BOLDEN. IV&V or independent verification and validation is a process that NASA uses. I think most industries use it, but NASA uses the process to look at dominantly software to make sure that we can put faults and failures and all kinds of stuff into the program and make sure that it responds appropriately, that it does not trip the software such that it just loses its mind, if you will. So IV&V does not do the critical software evaluations for the International Space Station, but it does critical software evaluations for some of our other activities. So that is the kind of work you do. You cannot just say, we are going to close down the one in West Virginia and go do it somewhere else because it takes time. You have got the talent, the brain power, and you have got the facilities that are there.

Mr. JENKINS. And when you make mention that some may have interpreted IG as suggesting, that leads me to believe that maybe—have you had a follow-up discussion with the IG and maybe the way it was written or interpreted, that maybe that is a conclusion that should not have been suggested?

General BOLDEN. I do not change the IG's mind. What I do is I respond to the IG's report. What we do is we cooperate with them as they formulate the report and we give them as much as we can in hopes that the report will not reflect something that we think is inaccurate. But we do respond. If they give us recommendations or findings or the like, then we respond back to them. So I do not remember exactly what our responses were, but I think we told the

IG that we appreciated very much the recommendation. However, these are the actions that we are taking right now.

As the chairman mentioned, the IG, the IG's report to me is not a directive. That is a report of a finding by an Inspector General. The Office of the Inspector General does not direct the Agency to do anything. As the CEO of the agency, if I want to assume the risk, then I just tell the IG I really appreciate this point. I think you may be correct, but I am willing to assume that risk at this time.

Mr. JENKINS. The second and final area of interest to me is again your financial support. I just spoke last night to the EPSCoR program and had the honor of introducing NASA's former chief scientist who is now head of the National Science Foundation. Your support for undergraduate research, STEM programs—today happens to be Undergraduate Research Day in West Virginia that a lot of bright-minded students make presentations.

NASA's investment in education through the consortium, the space consortium and all, can you share with me and the committee some of the values of that effort and as part of your budget?

General BOLDEN. I do not think we can put enough money into the work that NASA does towards STEM education. I say that not lightly to be quite honest. I think you can always use more.

However, I do say all the time that NASA spends 16 and if we get the requested President's budget, we will devote \$18.5 billion to STEM education in this country because there is nothing that we do in the Agency, there is no office, no department, no anything that does not have some impact on STEM education, whether it is just employees acting as mentors or providing NASA content to a school or something of that nature that does not get counted in an education budget, but we have \$16.8 billion that we apply towards STEM education. It is an incredible value.

Mr. JENKINS. Major General, thank you.

General BOLDEN. Thank you.

Mr. CULBERSON. Thank you, Mr. Jenkins.

Mr. JENKINS. Thank you, Mr. Chairman.

EDUCATION AND OUTREACH PROGRAMS—NASA EXPLORER SCHOOLS

Mr. CULBERSON. And after we go through the Members, I want to be sure to recognize our colleague, Mr. Schiff, for a statement after the Members that were here first are recognized.

So I want to go at this time to Mr. Serrano.

Mr. SERRANO. Thank you so much.

I admire, respect, and love my ranking member, but he almost gave me a heart attack when he said asteroids were not important since one of my questions is going to be about the Arecibo Puerto Rican observatory.

And let me first tell you, sir, that one of the best experiences I have had as a Member of this committee has been not only to have been twice the ranking member under Hal Rogers and Frank Wolf but also the work that we have done in our districts. And I wanted to speak to you about that.

The last time we had an event that was a wonderful event, we had flown the Puerto Rican flag on one of the flights. Then we had flown the Dominican flag on one of the flights. And astronauts

came down to the community college and presented both flags. And the room was full of kids and community people and it was just a wonderful, wonderful event.

And then there have been many times when astronauts have come into the classroom to speak and it is one of those few times where you do not have to worry about the children paying attention because, you know, they are, oh, you went up in space and they are captured.

So where is that program at? Those visits to schools, do you continue them? Has the budget hurt you, you know, in doing that kind of work because I think it is great and I support it totally?

General BOLDEN. Congressman, I think during the period of more active pursuit of sequester, I think everybody knows, it is common knowledge that travel in Federal agencies was significantly curtailed. So during that period of time, we did have to cut back on school visits and the like from astronauts and NASA employees. However, over the last year or so, we have relatively restored our school visits and our other kinds of outreach activities to some normalcy.

I was privileged to visit Puerto Rico earlier this year and actually had a chance to—you mentioned Arecibo, but had an opportunity to go out to the observatory there and walk on the telescope, on the disk and everything else and talk to students in Puerto Rico. There is nothing that promotes interest in STEM education, as you have said, like a hands-on experience for students.

Mr. SERRANO. Absolutely.

General BOLDEN. Mr. Jenkins, well, somebody mentioned, although he is not from Huntsville, but down in Huntsville, it used to be called the moon buggy challenge and it is now called the NASA Human Exploration Rover Challenge, but we have students from all over the world—

Mr. SERRANO. Right.

General BOLDEN [continued]. Who come to compete in that and build buggies from bicycle parts and other kinds of things. So we still continue our outreach programs.

ARECIBO OBSERVATORY

Mr. SERRANO. And I encourage you to do so. And I will be a Member of this committee that will push for that because I think those are wonderful programs and a wonderful way for NASA, and NASA is one of those agencies that does not hurt anybody. On the contrary, it just brings joy and solidifies our future.

Let me move on to the observatory. The observatory is funded mostly by NSF, as you know, and NASA plays a major role. And a couple years ago, they were actually talking not only of backing off from helping the observatory but even getting rid of it.

And not this committee, I wish I could say this committee, but it was scientists who wrote especially in a report that said that Arecibo played a major role in keeping an eye on things that have to be kept an eye on. So, of course, I am in support of keeping it open. I know the chairman is also and so is Mr. Honda and the ranking member and other people.

What is the status right now at least from NASA's point of view and as to your knowledge, although that is a question for them?

Is NSF still thinking about, although they have backed away from that, doing something?

General BOLDEN. I cannot answer what Dr. Cordova and the NSF, what their position is right now, but I can say that NASA, currently, provides in the neighborhood of \$3 million each year for support at Arecibo. But I will take it for the record and get that specific amount to you.

So we continue to push for the telescope and its availability. In fact, one of the reasons that I went to Puerto Rico was because I had heard about it, but I had never seen it and I wanted to go meet the people there. And they are incredibly enthusiastic about what they do.

So I think it is value. The unfortunate thing is it is not a NASA asset. It is a National Science Foundation asset. It is like McMurdo Bay in Antarctica. It is like many of the research facilities around the world the way that responsibility is divided up. NASA frequently is the dominant player at our international research facilities, but they do not belong to us.

Mr. SERRANO. Right.

General BOLDEN. They belong to other agencies of the government and we do not have a say in whether or not they close them or open them.

Mr. SERRANO. Right.

General BOLDEN. But we generally—

Mr. SERRANO. My time is up, but I hope that we can work together for the part that NASA plays in keeping Arecibo open. And it is a good thing to see that the chairman has always been a supporter. The man that has always been a supporter of Arecibo is now chairman of the committee and the ranking member has always been supportive. So we will continue to work on it.

General BOLDEN. And, sir, I will try to get for the record, we will contact the NSF and see if they can provide us a comment since I do not—

Mr. SERRANO. Well, turn it over to you and then we will take good care of you.

General BOLDEN. No, no, no, no, no. I am not asking for more on my plate. I do not need more.

Mr. CULBERSON. What is the \$3 million a year for?

General BOLDEN. Let me find out specifically what it is for, but I think most of it is for programs and instruments and—
[The information follows:]

ARECIBO RADIO OBSERVATORY

NASA's Planetary Science Near Earth Object (NEO) Program uses the National Science Foundation's Arecibo Radio Observatory for its planetary radar capability, particularly for this asset's critical ability to characterize Earth approaching asteroids and precisely determine their orbits, size, shape and rotation dynamics. Radar studies of the Moon, other planets and their moons are conducted as well. Often the Arecibo facility is used in cooperation with NASA's own Goldstone Solar System Radar facility to provide even higher precision data on these objects.

There are two components to NASA's current funding of Arecibo, contractually with the Universities Space Research Association, which has the cooperative agreement with NSF to manage and operate the Observatory. The first is a five-year grant (FY 2012–2016) of about \$2M per year (\$2.074M in FY 2015, but increasing slightly each year to maintain purchasing power) to operate and maintain the radar and perform a crucial baseline of observations on NEOs and the planets for NASA's planetary science programs. The second is a NEO Observations Program science

grant for \$1.5M per year for 4 years (2013 through 2016) to obtain additional collection and analyses of radar observations on all accessible near Earth asteroids.

Mr. CULBERSON. Instrument time?

General BOLDEN. Instrument time or instrument modernization, because although the facility belongs to NSF, we frequently will have——

Mr. CULBERSON. Your customer?

General BOLDEN [continued]. Investigators who go in and actually build instruments that are used at the observatory.

Mr. CULBERSON. I know they need an upgrade on——

General BOLDEN. They do.

Mr. CULBERSON [continued]. A lot of their equipment and——

General BOLDEN. Right.

Mr. CULBERSON [continued]. Some maintenance. I know that one of the cables had a problem. But, nevertheless, we are——

General BOLDEN. It was working when I was there, but it is not in great shape.

Mr. SERRANO. I think it was the cable James Bond hung from when they made the movie there. [Laughter].

Mr. FATTAH. Mr. Chairman, I think the Member can be assured that we are interested. This is part of a series of observatories around the world that are critically important to NASA's success.

Mr. CULBERSON. Absolutely.

Mr. FATTAH. Also to deal with asteroids that might be coming our way.

Mr. CULBERSON. Absolutely. Thank you.

Mr. SERRANO. Thank you, Mr. Chairman.

Mr. CULBERSON. Thank you, Mr. Serrano.

Mr. SERRANO. Thank you.

Mr. CULBERSON. Mr. Kilmer.

SMALL SATELLITE PROGRAMS

Mr. KILMER. Thank you, Mr. Chairman. And I will just echo Mr. Serrano's enthusiasm for the NASA Explorer Schools. We have got one in my district and it was certainly one of the highlights.

I had a question regarding small satellites. That is one of the fastest growing segments of the space industry, high relevance for science and national security and commercial industry. And NASA has really helped advance development and demonstration of technologies in all sorts of arenas, whether it be communications, navigation, propulsion, power, science instrument capabilities. So how do we expand and accelerate those types of cost-effective investments and how do we ensure that NASA's program is taking full advantage of investments that are also being made by industry and by the Defense Department?

General BOLDEN. We collaborate with the Defense Department, the NRO, industry, academia and everybody in trying to promote the use of small satellites and a specific type of small satellite called CubeSat. We work with our international partners. There is now a private entity, and I just drew a blank on what the name of the company is, that provides the program that gets CubeSats to the International Space Station for distribution or for deployment from the Japanese Experiment Module. We have the CubeSat deployment mechanism on the Japanese Experiment Module and it

is the only one that has an airlock. So they can actually bring the deployer inside, load it up with CubeSats, put it back out and then deploy them. So it is a program that we really push.

The Ames Research Center out in Mountain View, California tends to be the center of effort for CubeSat development in small sats for a number of reasons. They are in the heart of Silicon Valley and so they have a way of getting not just American students, but students all over the world interested in this. I just came back from a trip to South America and in the four countries I visited one of the things that we could talk about with them in trying to expand the number of international what we call non-traditional partners was the use of CubeSats, teaching students to use CubeSat to do very basic things, and it allows them to become partners.

INTERNATIONAL SPACE STATION

Mr. KILMER. Thank you. You mentioned the space station, I wanted to ask about that program. To some degree, it can be viewed as too big to fail. What recourse does NASA have if commercial crew contractors are unable to meet the 2017 milestone of sending astronauts to the space station from American soil or if program funds are exhausted?

General BOLDEN. Nothing is too big to fail, in my estimation. However, there are some things that are critical for the success of keeping America number one in space, the International Space Station is one of those. It is a very unique facility, it is a one-of-a-kind facility, it is a mini United Nations, and it is a place where we do technology development and human research. It is critical, I don't even want to think about what happens if the Russians decide that they want to change the way they operate with us. That is what makes it so critical that we receive full funding for Commercial Crew so that we can guarantee that it is not NASA, not the U.S. Government, not money that kept American industry from delivering. I have faith in American industry, I always have. I talked about, when we put a plan together, work it with them and say we can do something, we do it on time and on cost.

I have no reason to believe that SpaceX and Boeing will not be able to bring in their programs in 2017 as they have planned. They have given us milestones, they get paid for milestones. Those are firm fixed-price contracts, so we know that it will not overrun, because any additional money over and above what they think it is going to cost the company has to fund. So you would have to find Boeing or SpaceX deciding that it is no longer fiscally viable for the company, the corporation, for them not to deliver.

Mr. KILMER. Thanks. I see I am near time up. So I will submit some other questions for the record and thank you, Mr. Chairman.

Mr. FATTAH. If the Chairman would yield for a minute. For instance, because I don't want there to be unnecessary concern, SpaceX has met the first milestone, right?

General BOLDEN. Oh, SpaceX has met several milestones on the Commercial Crew milestone list.

Mr. FATTAH. Okay. And Boeing?

General BOLDEN. And Boeing, they both have.

Mr. FATTAH. Right. So, I mean, there is not that I am aware of any concern that we will not be able to meet this time line as long as we can meet the budget number.

Mr. KILMER. That is the key, right?

General BOLDEN. And that was the point I tried to make, Congressman Fattah, was industry is going to perform as long as the government does not renege on its promise to pay. We promised that we would pay them \$6.2 billion combined and, unless we renege on that, then I think Boeing and SpaceX will deliver.

Mr. KILMER. Thank you. Thank you, Mr. Chairman.

Mr. CULBERSON. Thank you, Mr. Kilmer.

Mr. Honda.

STRATOSPHERIC OBSERVATORY FOR INFRARED ASTRONOMY (SOFIA)

Mr. HONDA. Thank you, Mr. Chairman. And again, welcome, Mr. Administrator. It is great to see you here and it is great to have an administrator that has got a science background and knows what the hell you are talking about. [Laughter.]

You know, sometimes we have leaders that are more of a book-keeper than of looking at funding programs based upon its mission and we have gone through that period now. It is good to have you. And I understand that we already had a comment about the 100th year celebration, so I will not say anything about that. But I know that NASA Ames Center Director Pete Worden is retiring and it is going to be a great loss to us, but it is going to be good for the private industry. And I guess that is going to be tough to find someone that is going to replace him and fill his shoes, but I think that we are here to support that kind of a direction that we find someone that will enhance Ames and NASA and keep the A in NASA going.

One of the questions I had was that the Administration's handling of the Stratospheric Observatory for Infrared Astronomy, better known as SOFIA, in the President's 2016 budget notes that NASA plans to hold a senior review for SOFIA in the spring of 2016. And, as you know, SOFIA just became fully operational in February of 2014 and was in Germany for a good portion of last year undergoing a heavy maintenance visit. Now, this senior review is usually after four years of operation and I guess my question is, why is it so early? Because it gives the sense that NASA will be setting up SOFIA to fail when it only had approximately one year rather than the four years fully to, you know, open its wings and, you know, have its contribution better known. Can you address yourself to that?

General BOLDEN. Congressman, when I approached the folks in our Science Mission Directorate I learned one of our assets with which I am very familiar, the Hubble Space Telescope actually underwent senior review much earlier than it was scheduled to because we wanted to make sure that we had good definition on the out-year programs for it, because that is basically what we are trying to do with SOFIA. We are trying to take a look at its performance to date. Had we flown SOFIA when we were originally scheduled to fly it, we would have been well beyond a normal senior review at this time. But because of issues with the development of SOFIA and getting it to operational condition, then we are some-

what behind in where we would have been. But the senior review is to make a determination of what its future missions should be, how we balance the schedule for its flights, to evaluate whether or not the science community thinks that we can fly fewer flights and get the same amount of data that we wanted before. So it is not a review that I look at as a reason or something trying to justify shutting down SOFIA. SOFIA is funded in our 2015 bill thanks to this committee and we requested funding for it in the 2016 request.

Mr. HONDA. So the life and its expectation is to continue, it is just you are doing this review with the understanding that there may be a lot of stuff that has already been—could be done, but usually you would have waited a few more years, but you have some confidence in its performance.

General BOLDEN. I have confidence in SOFIA's performance to date and I have confidence in—what I do not know, because it is out of my area of expertise, is what does the science community feel the relative value of SOFIA is for other assets that gather the same type of data. SOFIA is somewhat unique, to be quite honest, because it is an in-the-atmosphere observatory that I understand looks in different wavelengths than many other of the assets that we have, whether in space or on the ground. But the science community is always looking at how do they get the most efficient results from the experiments they have. This goes back to, how long do you fly anything?

Mr. HONDA. Okay.

General BOLDEN. But I am not concerned about SOFIA's performance.

PROTECTING THE NASA WORKFORCE

Mr. HONDA. Okay. I appreciate that. And one of the concerns I have about NASA is that over the years we have lost staffing, civil servants, if you will, and it does not feel like we are setting up a system where we want to attract and retain our employees at NASA. And so I guess the question is, well, what are you doing to protect the NASA workforce and ensure that the NASA Centers have the ability to hire and retain the best and the brightest scientists? Because that is our human, you know, treasure that we have that we have built up over the years. And from looking at continuing programs like STEM and everything else like that, these are the folks that have the deepest experience to be able to talk to youngsters.

General BOLDEN. Congressman, at the risk of offending the committee, I am going to take a chance.

Mr. HONDA. Go ahead.

General BOLDEN. The reductions in force that you see are not things that we do voluntarily. This Congress believes that all of the nation's problems rest with civil servants. That is the workforce you are talking about. We are not talking about contractors. When the Congress says that the problem is government employees, that is the people sitting behind me, that is what you are talking about. That is the people at Ames and at Armstrong and all over this country. You do not get something for nothing. If you want us to cut the size of government, you are talking about cutting people.

Mr. HONDA. Okay.

General BOLDEN. And I understand what you are saying, but that is a contributor to the problem that we are. When we looked at sequestration, you are talking about people.

Mr. HONDA. I agree with you and I think that this is a message that needs to resonate among members of Congress and those who are in positions to make sure that we do not go in that direction, and that we understand clearly that you get what you pay for. And based upon the comments I heard this morning about the value of centers and how it is run and who runs it, that we should take that position when we look at budget and planning in the future and making sure that we do not vilify civil servants, but we embrace them and make sure that we understand their full value. And that cuts across the entire gamut and I am sure that my colleagues on this subcommittee agrees with that point, is that we have to put up the fight to protect the assets that we have right now and especially the human assets.

General BOLDEN. Thank you.

Mr. HONDA. Thank you.

Mr. CULBERSON. Thank you, Mr. Honda. We have been joined by Chairman Aderholt, another strong advocate and supporter of NASA and our manned program as I am, and it is my pleasure to introduce at this time the gentleman from Alabama. Mr. Aderholt.

Mr. ADERHOLT. Thank you. Mr. Administrator, good to have you here.

General BOLDEN. Thank you.

EXPLORATION SYSTEM DEVELOPMENT

Mr. ADERHOLT. First of all, let me apologize for my voice. I am overcoming a sore throat and I was in a hearing with Chairman Rogers this morning. I have been chairing the Ag Subcommittee Appropriations and we had the FDA Commissioner in this morning. And he said it reminded him of what Mark Twain said about Wagner's music, he said it is not as bad as it sounds. So that is sort of why—I am not as bad as it sounds. But anyway, I just have a couple of questions. Thank you for being here. And I appreciate Chairman Culberson for letting me slip in here and ask a few questions.

I want to ask one question about the SLS program and then a second very short question, and then the remaining I will submit for the record. But I am glad to hear the integration plan for SLS, Orion and ground operations are underway at headquarters. Slipping beyond the 2018 for the EM-1 flight is a little more disconcerting. As you know, on the EM-1 flight, we use an upper stage known as ICPS. I do not know of a definite budget plan in NASA's out years for the flights beyond EM-1, but it seems to me that there must be a firm decision soon on whether to human rate the ICPS. And I am wondering if not human rating the ICPS and instead human rating the new upper stage for use on the EM-2 mission could save taxpayer dollars. Progress soon on the upper stage might allow for options as we plan large science missions such as the Europa Clipper. We could also use the power of the upper stage to cut the flight time by half or more and get the data back to our scientists faster. I just wanted to turn it over to you on what your thoughts are on this approach.

General BOLDEN. Yes, sir. As I was commenting earlier before you came in, our approach to keep us as the leaders in space is to try to put together a program in its totality. When you talk about human exploration or about exploration of our solar system and let's just not even—human and robotic exploration, our program calls for being able to get humans first of all into cislunar space, but that is not the only thing we want to do. We want to be able to go on to Mars. So the reason that it has taken us to this point to be able to give you all the answers that you want on SLS and Orion is because we are looking at how we get the totality of the program in place. How do we get multiple flights out of SLS and Orion? If I focus on the very first flight, which happens to be unmanned, and that is where my focus is, then I could easily lose sight of what I need for the downstream flight. So we find that it is more economical and it is much more efficient if we plan for a block of flights, the program. Such that, if you gave me more money, as you are probably going to ask, what would I do? I would buy down risk. What do I mean when I say buy down risk for SLS and Orion? I would go and have Bill Gerstenmaier, I would approve his purchase of pieces and parts for EM-3, -4, -5, farther down the line. So that when you go to SpaceX and you look on their floor, there are engines all over the place. There are engines for flights they do not have yet. That is the way they buy down risk, that is the way industry does it. You put assets in place so that you can carry out a program years in advance. So that is what I would do. I would not focus on trying to get EM-1 earlier, EM-2 earlier. We have a program in place that calls for them to fly at a particular date and we are not going to change that appreciably with more money.

So I think an Exploration Upper Stage is what you are talking about, the EUS. The interim upper stage is something because we do not have the one that we really want to fly for all of our exploration missions, it is an interim upper stage that will allow us to fly the first mission, but that is not what we would ideally like to live with. But that again is, we will come back to the Congress and tell you what we need in a budget that will sustain us through multiple administrations and multiple congresses, as opposed to one flight.

ROCKET PROPULSION

Mr. ADERHOLT. I see my time is slipping away, but let me ask this one last question before I have to go back to the subcommittee that I have been chairing now. The Marshall Space Flight Center, which you know is on the edge of my district, has a tremendous rocket propulsion skill base there. It has a rich history in propulsion projects going back to the days of Von Braun. The National Institute for Rocket Propulsion Systems or the NIRPS, as the acronym goes, is located at Marshall and I hear it is doing great things for the nation. Would you agree that it is doing good things?

General BOLDEN. We affectionately call it NIRPS and NIRPS is doing great things. In fact if you all will allow me to use the acronym, just because it is easier. But the important thing about NIRPS was—and it was the brainchild of some of the engine folk at Marshall, because they saw how NASA was working on engine

technology, DOD was working on engine technology, industry was working on engine technology. So what the institute attempts to do is to bring all the disparate bodies together to talk about national needs and so that is what is done there. We have buy-in from the Air Force, we have buy-in from industry. So everyone is represented when you go—if you were to go to Marshall and ask somebody, when was the last time the Air Force was in here or when was the last time industry was in here, they would probably tell you, well, we had a meeting yesterday and everybody was here. So that was its intent and I think it is vital for the future of propulsion for this nation.

Mr. ADERHOLT. Good to hear. Well, thank you. Thank you, Mr. Administrator, for being here and thank you, Mr. Chairman.

Mr. CULBERSON. Thank you, Chairman Aderholt.

Let me recognize the young lady from Alabama, Mrs. Roby.

EXPLORATION SYSTEMS DEVELOPMENT

Mrs. ROBY. Well, you get two in a row. So I want to continue with what my colleague from Alabama was talking about as it relates to Marshall Space Flight Center's activities. And across Alabama the impact is nearly 20,000 jobs, their total economic impact in the State of Alabama is \$3.3 billion. In terms of procurement, almost 60 percent of Marshall dollars are spent in Alabama. The Space Launch System or SLS results in almost half the jobs related to Marshall. And in addition to that, the International Space Station is managed by folks at Marshall through the Payload Operations Center. Personnel manage experiments on the Station around the clock and they integrate the various components and manage the logistics involved in getting these payloads to the station. They develop systems at Marshall used for experiments in life support and the Oxygen and Water Recycling Unit is just one example of the ingenuity from the people at Marshall.

So back to SLS and thank you for being here today. I know NASA intends to launch the first full-scale test flight by late 2017 and I wanted you to take some time to comment about the needed steps and proper funding in this year's budget request and future requests that are needed to keep that launch date on time.

General BOLDEN. Congresswoman—

Mr. CULBERSON. Great question.

General BOLDEN. Okay. I thought I answered it, but I will try it again. Before you came in, not since you came in.

Mrs. ROBY. Okay. Sorry. There are four hearings going on at the same time.

General BOLDEN. No, no, no, because I obviously did not answer it as well as I thought I did. In response to your question, the one thing that all of us agree is that we have to maintain America's leadership in space. And what I attempted to do or what my team attempted to do when we gave this budget recommendation to the President and he sent it over here was there are three things that we want to do. We want to continue to fund our capability to launch American astronauts from American soil, so that's Commercial Crew, Commercial Cargo for cargo and the like. We want to be able to get the three legs of the stool in place for deep space exploration, that's Commercial Crew & Cargo, a low Earth orbit in-

infrastructure, the International Space Station, and SLS and Orion. And the final thing we want to do is we want to make sure that we maintain our preeminence in science, technology and engineering. In order to do all those, my job is to try to parse the funds up that we request to you such that it supports a well planned program to get us to Point A, if you will, which is what you are talking about.

First flight for us has already occurred, that was Orion on the 5th of December, 2014. So that was the first flight in our exploration program, very successful. It was not in its configuration for sending humans to deep space, but that was the first flight, very successful. The second flight for us will come some time after 2018, to be precise. The reason that I say some time after 2018 and we will tell this Congress much more precisely some time this summer when we finish with the next milestone on Orion itself.

You may say, I asked you about SLS, why are you telling me about Orion? Because they are a pair. We are not talking about flying SLS without Orion for deep space exploration just yet. So when we know when Orion will be ready to fly, then we will know when we can fly an SLS-Orion pair. SLS ground systems are ready now for a launch-readiness date of late 2018, so that is in place. We do not have a launch-readiness date yet for Orion, so we will give you that.

Mrs. ROBY. What would be the most negative or detrimental thing that could contribute to not allowing you to reach these goals?

General BOLDEN. Not to fund Commercial Crew and find that we have got to go back to the Russians and pay more money for Soyuz seats over and over and over again, because it would mean that the U.S. has given up on having its own capability to get its crews to low Earth orbit. If we do not have the low Earth orbit infrastructure that I talked about very early on in my testimony, there is no exploration program. It is a program, it is an integrated program, and it is really important for this committee to understand that. We found, Mr. Chairman, that there was a piece of the program we never even considered before we started looking at Europa and how do we speed that mission up. So potentially, and I have to be very careful because the Chairman wants me to say we are going to fly an SLS, we are not ready there yet. But if we do not have SLS and Orion supported by Commercial Crew & Cargo and a viable low Earth orbit infrastructure, there is no SLS Europa mission. I would not bring this committee a proposal that I build an SLS so that we can go to Europa, but I would bring this committee a proposal that says we have a program for a journey to Mars and here is the way that integrated program works. Here are the three legs that I have got to have in place, Commercial Crew & Cargo, I have got to have the International Space Station for some period of time now to buy down the risk there, and then I have got to have SLS and Orion. They are all necessary, but I do not need to spend all the money on all of them right now to get there.

Mrs. ROBY. Thank you very much. I yield back.

Mr. CULBERSON. Thank you. I recognize the new ranking member of the Intelligence Committee, and a valued member of this

subcommittee who has reserved his seniority, my good friend Mr. Schiff from California for any statement he would like to make.

PLANETARY SCIENCE

Mr. SCHIFF. Thank you very much, Mr. Chairman, for recognizing me and allowing me to attend this important hearing. I look forward to working with you, as well as the Administrator, to ensure NASA receives the necessary funding to fulfill its core missions. I may be on leave technically, but my heart is still very much with NASA and my commitment as well.

In particular, I am hopeful that Congress can work with NASA to provide the funding for NASA's Planetary Science Division, so that we can continue to learn more about our solar system from Mars 2020 to a mission to Jupiter's exciting moon Europa. These missions must be fully funded and made a priority for both NASA and the Congress. I share the conviction that our Chairman has that we need to make every effort to fund the priorities of the Decadal Survey. These are the nation's top most scientific priorities and the potential for really revelatory discoveries is just so exciting. And so I stand shoulder-to-shoulder with our Chairman.

And I wonder, Mr. Chairman, if I could submit questions for the record, if I am permitted to do so.

Mr. CULBERSON. We would be happy to do so.

Mr. SCHIFF. But I thank the gentleman for allowing me to attend and for all of his great advocacy for planetary science and for all of NASA. I am happy to yield back.

Mr. CULBERSON. We are going to continue to rely on your advice and guidance. Thank you very much.

Mr. SCHIFF. Thank you, Mr. Chairman.

NAME BRAND RECOGNITION SURVEY

Mr. CULBERSON. It was a privilege to work with you and the California delegation and my good friend Mr. Fattah. This whole committee is devoted to ensuring that NASA has the resources and the support that you need, sir, to do your mission. And I think as Mr. Honda said, or Mr. Serrano, that everything NASA does is just pure good. That is actually a nice way to look at it. And I would frankly love to see if you could, or somebody in your shop, find that survey that Sean O'Keefe did. Remember he retained a firm in Baltimore to do a name brand recognition goodwill survey of NASA and discovered that after the United States Marine Corps, General Bolden, that NASA had the highest positive name ID of any entity of the Federal Government. Am I remembering that correctly? That is just extraordinary. And we are here to help you and support you.

[The information follows:]



NASA in the Public Eye

A Glimpse of Public Perceptions Over the Past Decade

126

Briefing to the National Research Council
Committee on Human Spaceflight
Public and Stakeholder Opinions Panel

Dr. Rebecca Spyke Keiser
NASA Associate Deputy Administrator
for Strategy and Policy

June 19, 2013



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 - As measured and presented by three NASA commissioned studies (2004, 2007, 2009)
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 - Conclusions
- Themes and observations from the studies
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Research regarding public understanding of NASA conducted over the past decade



- **Harmonics International study – 2004**
 - Focus groups and interviews with:
 - Educators and children
 - Public
 - Polls on potential elements of and penetration of President's vision
- **ViaNovo research and analysis, in partnership with the Everett Group – 2007**
 - Review of existing market research, including 50+ studies, presentations, and other materials conducted by a multitude of organizations including:
 - Harmonics International Surveys and Studies (2004)
 - Dittmar & Associates Surveys (late 2004)
 - Gallup Surveys (2003-2006)
 - Coalition for Space Exploration Focus Groups (Spring 2006)
 - The Unland Company Focus Groups (Jan-Feb 2005)
- **ViaNovo research and analysis, in partnership with the Everett Group – 2009**
 - Focus groups – 8 nationwide in 4 cities (Richmond, Boston, Phoenix, Portland)
 - National telephone survey of 1001 participants

Public View in 2004 - Key Findings from Harmonics International Study



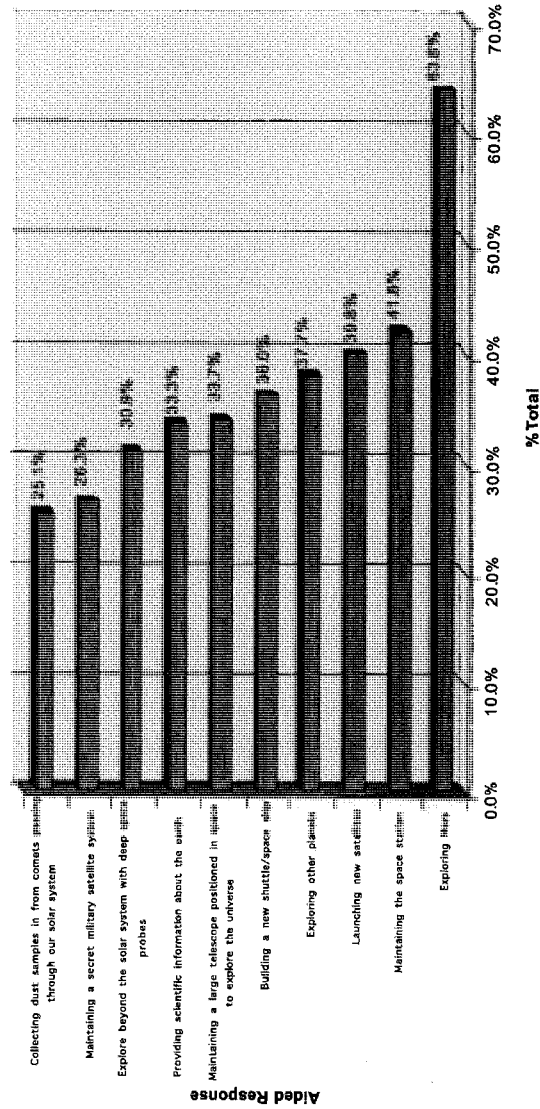
1. People want to believe in NASA.
 - And the window of opportunity is now.
2. NASA's 'brand' is extremely strong.
 - The problem is lack of effective communications.
3. There is strong desire to know what NASA does.
 - But today that knowledge is very thin.
4. The public look to NASA for a vision of exploration.
 - Between Columbia and the CAIB report, 2,250 articles were written about NASA and vision, most calling for NASA to develop a vision
5. There is no blame associated with Columbia:
 - The public understands the risks and sentiment is supportive.

Public Knowledge About NASA – Harmonics International Study (2004)



Survey results reveal the level of public knowledge of NASA's current work is low.

Q: What specific activities, if any, are you fairly certain NASA is doing in space right now, as opposed to in the past or future?



Public Beliefs on NASA's Benefits – Harmonics International Study (2004)



Study indicates benefits that were perceived as essential and assessment of how NASA delivers.

Top benefits that are essential for NASA to do*	Essential	Delivers
Advance knowledge	67%	63%
Benefit general aviation safety and security	62%	50%
Aid national security	60%	48%
Increase our understanding of Earth	58%	52%
Increase our understanding of the Universe	57%	61%
Helps lead to medical advances	52%	43%
Is on the cutting edge	52%	51%
Makes us feel a sense of pride	48%	50%
Involves exploring space	47%	68%

Public View of NASA: Key Conclusions - Harmonics International Study (2004)



The good news: NASA enjoys highly favorable 'brand' equity

- 80% overall interest in the space program (39% very interested).
- 84% feel NASA is doing a good job (33% excellent).
- 80% feel it is important that the U.S. and NASA be 'number 1' in space (48% extremely important).
- 75% feel that their personal lives are better because of NASA's work (35% much better).
- 86% feel the country is better off because of NASA's work (46% much better).

The bad news: People have little or no specific knowledge of what NASA does or the benefits

- When asked 'What is NASA?'
 - 42% respond with only the name, and only half of them got it right.
 - 24% talk about space programs; 16% exploration and research; 7% do not know.
- On average, a person can only think of two needs that NASA fulfills; 30% can think of only one.
- People generally can only think of one benefit from the work NASA does, and the answers are highly fragmented.

Public View in 2007 - Key Findings from ViaNovo Study



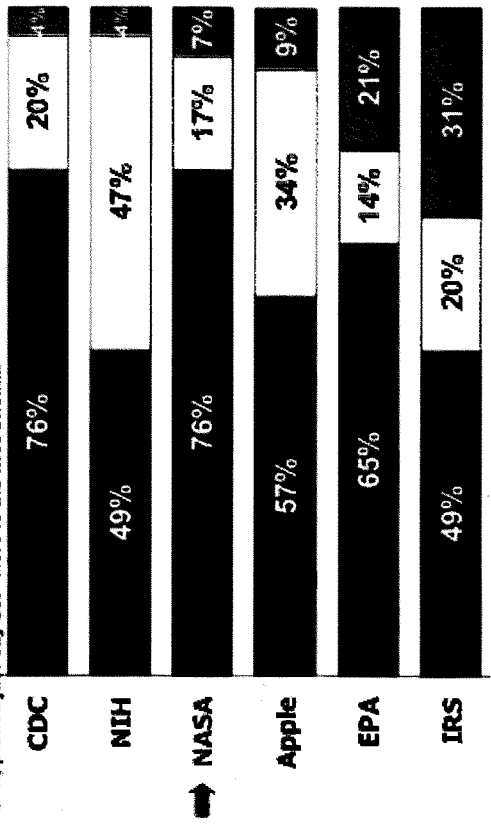
1. NASA's overall public image remains high and a large number of Americans believe continuing space exploration is important
2. However, fewer Americans rate NASA as relevant to their daily lives and perceptions of NASA's economic contribution vary
3. Telling people about specific NASA-related technologies has a tremendous impact on both relevance and economic measures
4. Among messages tested, there were no "weak" reasons for continuing space exploration, though some reasons were stronger than others
5. When talking about NASA programs and activities, framing NASA communications in terms of relevance and benefits is most effective



NASA's Public Image – ViaNovo Study (2007)

Research indicates NASA's public image remains strong.

Q. I would like to read you some names of several organizations in the news. For each one, please tell me whether you have a favorable or unfavorable impression of that organization. If you've never heard of it, please just say so. Here is the first one.



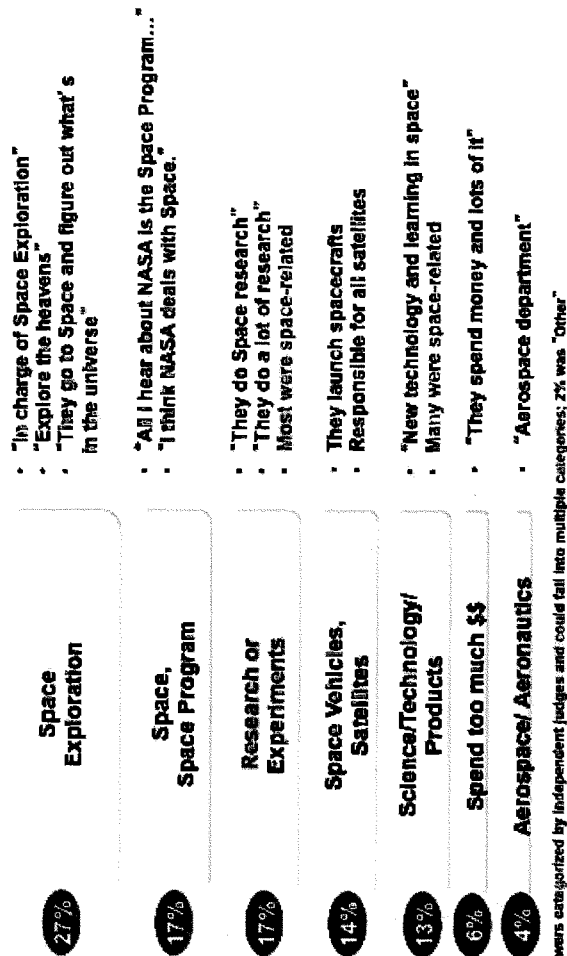
Favorable No Op/never Heard Unfavorable

Public Knowledge About NASA – ViaNovo Study (2007)



Similar to the 2004 data, research results indicate the level of public knowledge of NASA's current work is low.

Q. In your own words, please describe what you think NASA does? (Open-Ended Question)



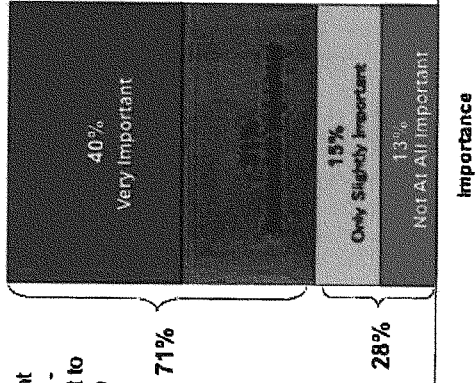
NOTE: Answers categorized by independent judges and could fall into multiple categories; 2% was "Other"

Public View on NASA's Direction - ViaNovo Study (2007)



Research paints a positive picture of public support for future space exploration.

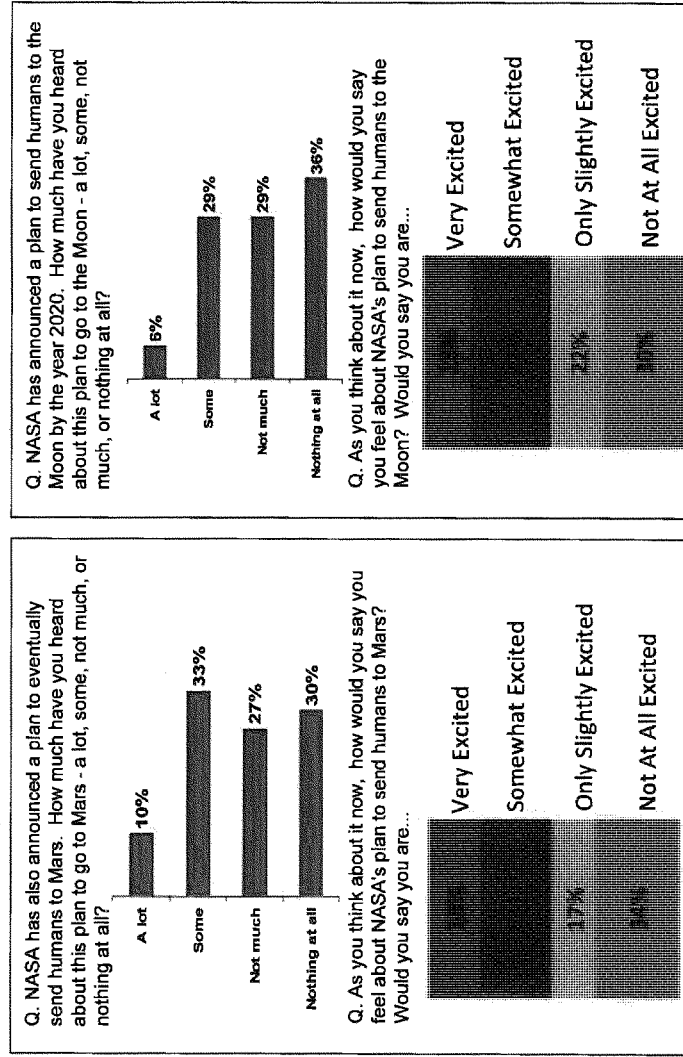
Q. Now I want you to think a moment about one of NASA's main activities - exploring space. How important is it to you that NASA continues with space exploration?



Public View of Human Spaceflight Direction – ViaNovo Study (2007)



Study addressed public awareness of and reaction to eventual Moon/Mars mission



What the Public Views as Drivers for Future Space Exploration – ViaNovo study (2007)



Study summarizes drivers identified by public as reasons for future space exploration.

Q: I am going to read you a list of reasons that some people give for why NASA should send humans to the Moon and Mars and continue space exploration in general. After I read each one, please tell me whether you find the reason very strong, somewhat strong, neither strong nor weak, somewhat weak, or very weak.

Space exploration has led to more than 1300 technologies such as GPS, heart defibrillators, smoke detectors and satellite radio. As we continue to explore, we will develop even more technologies to benefit life on Earth.

Space exploration engages and inspires the public, and encourages students to pursue studies in challenging, high-tech fields.

Space exploration will stimulate the economy and make America more competitive by creating new jobs, new industries and new technologies.

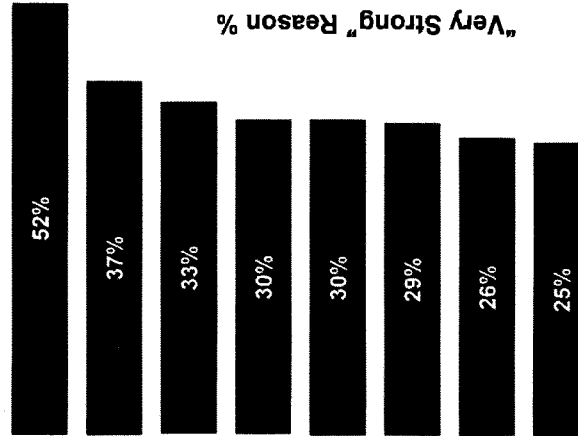
Space exploration satisfies our curiosity, advances our knowledge, and answers our fundamental questions about the history of the Earth, the solar system and the universe.

Going to the Moon and Mars will be a stunning achievement and enduring legacy to future generations of our desire to explore, learn and progress.

Exploring space will allow us to learn how to survive in other places in our solar system and beyond.

Space exploration provides a challenging, shared and peaceful activity that unites nations in pursuit of common goals.

Throughout history, the great nations have explored. The exploration of space enables the United States to lead the way toward expanding the boundaries of the last human frontier.

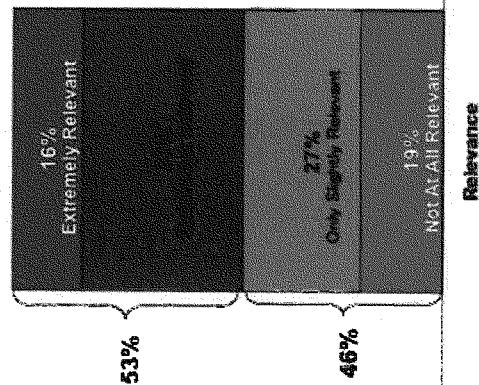


Public Opinion of NASA's Relevance – ViaNovo Study (2007)



Research shows just a slight majority of the public have some sense of relevance of NASA and its activities to their lives.

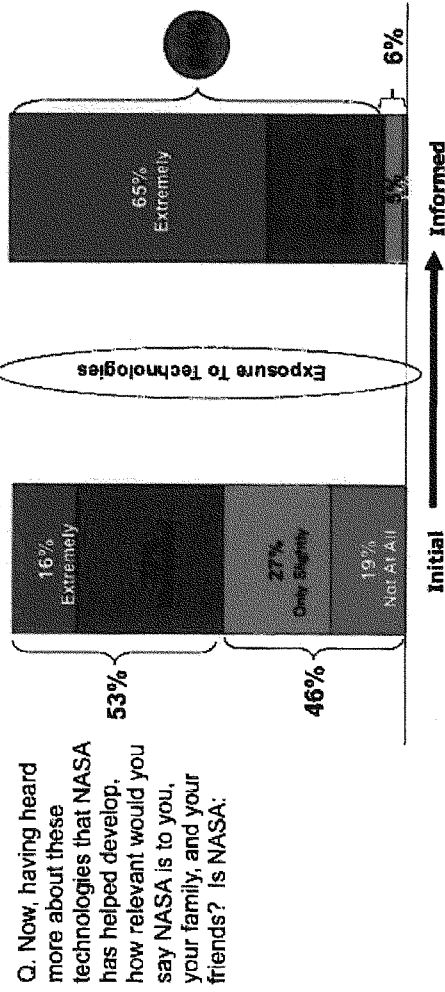
Q. Now thinking about NASA and how it relates to everyday life – how relevant would you say NASA and its activities are to you, your family, and your friends? Is NASA:



Public Opinion Shift of NASA's Relevance When More Informed – ViaNovo Study (2007)



This study demonstrated that informing the public will have substantial impact on the public's perception of NASA's relevance.



Differences in Public Opinion by Gender - ViaNovo Study (2007)



Research addresses differences of views represented by demographics, including gender.

Very Important/Somewhat

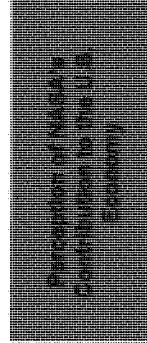
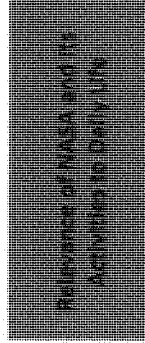
	Pre	Post
Men	74%	80%
Women	67%	81%

Extremely/Somewhat

	Pre	Post
Men	57%	92%
Women	49%	95%

Very Strong (9-10)

	Pre	Post
Men	11%	28%
Women	12%	48%



Differences in Public Opinion by Age - ViaNovo Study (2007)



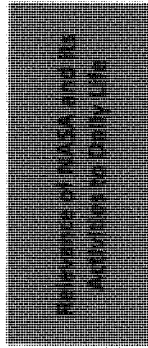
Research addresses differences of views represented by demographics, including age groups.

Very Important/Somewhat



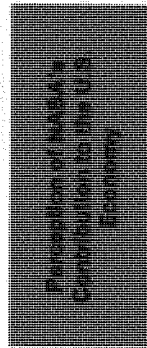
	Pre	Post
18-34	74%	87%
35-64	71%	80%
65+	66%	73%

Extremely/Somewhat



	Pre	Post
18-34	50%	96%
35-64	57%	94%
65+	53%	93%

Very Strong (9-10)



	Pre	Post
18-34	10%	38%
35-64	14%	39%
65+	12%	33%

Public View of NASA: Key Conclusions - ViaNovo Study (2007)



- NASA's overall public image remains high and a large number of Americans believe continuing space exploration is important.
- However, fewer Americans rate NASA as relevant to their daily lives and perceptions of NASA's economic contribution vary.
- Telling people about specific NASA-related technologies has a tremendous impact on both relevance and economic measures.

Public View in 2009 - Key Findings from ViaNovo Study



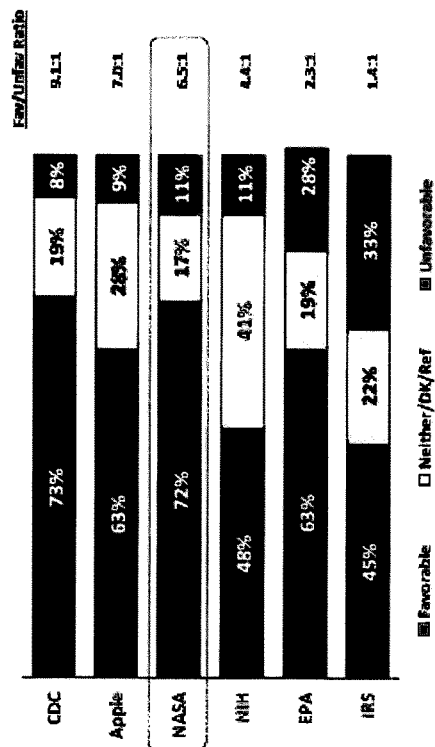
- NASA's public image remains strong.
- NASA's work is viewed almost exclusively as space-related.
- Overall public knowledge about NASA and its mission and activities continues to be very low.
- A super-majority believe it is important that NASA continue to explore space.
- Most Americans think we need to eventually send humans -- not just robots -- to Mars.
- Public places high value on NASA-related benefits, especially concrete safety and health contributions.

NASA's Public Image - ViaNovo Study (2009)



NASA's overall public image remains strong.

Q. I would like to read you some names of several organizations in the news. For each one, if please tell me whether you have a favorable or unfavorable impression of that organization. If you've never heard of it, just let me know.



NASA's Work Viewed Almost Exclusively as Space-Related

space exploration

research space-program

satellite

shuttle

telescopes

rocket

space station

planets

astronauts

Hubble

technology

moon

science

spacecraft

almost

first

man

went

to

space

experiment

don't know

space

program

satellite

shuttle

telescopes

rocket

space station

planets

astronauts

Hubble

technology

moon

science

spacecraft

almost

first

man

went

to

space

實則此乃一極端之利己主義也。蓋此輩之利己主義，乃係以犧牲他人之利益為其利己之手段。此輩之利己主義，乃係以犧牲他人之利益為其利己之手段。此輩之利己主義，乃係以犧牲他人之利益為其利己之手段。

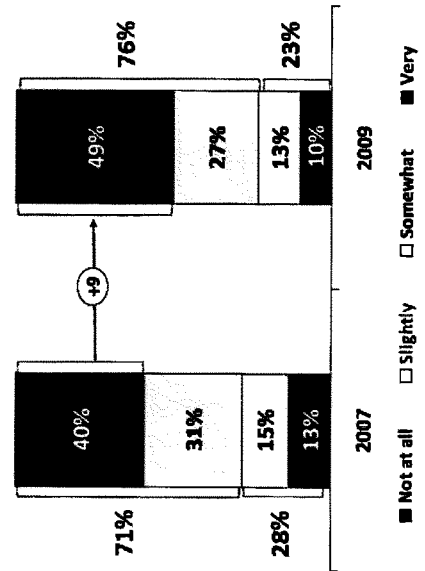


Public View of NASA's Direction – ViaNovo Study (2009)

Study shows improvement in public support for future space exploration.

A Supermajority Believe It is Important that NASA
Continue to Explore Space

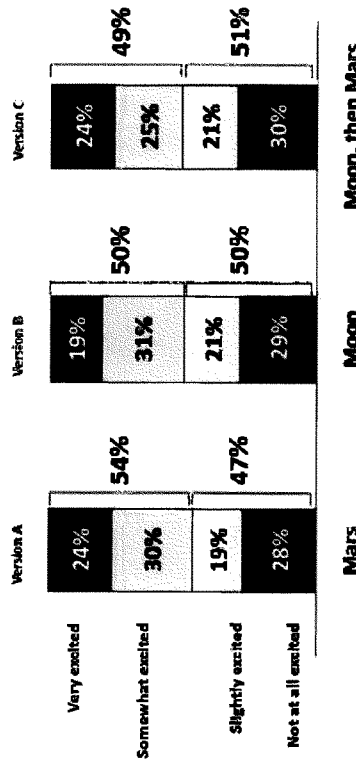
Now think about one of NASA's main activities – exploring space. How important is it to you,
if at all, that NASA continues with space exploration?



mission.

Americans' Excitement about a Moon and/or Mars mission Remains Mixed (And Linking Has No Impact)

One of NASA's programs, Constellation, is working to send humans to []...as you think about it now, how would you say you feel about those plans?



This level of excitement is virtually unchanged from 2007

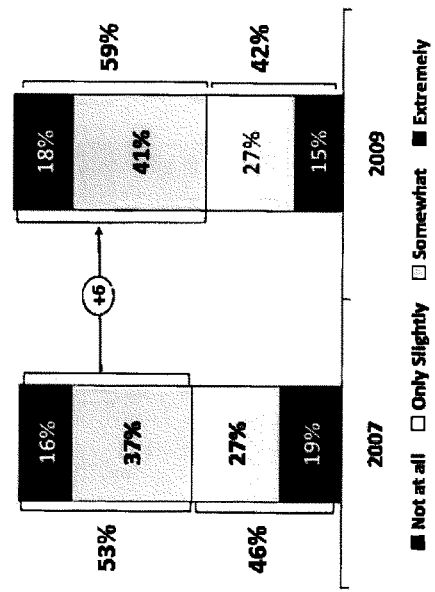


Public Opinion of NASA's Relevance – ViaNovo Study (2009)

This study shows small improvement in public view of NASA's relevance.

An Increasing Number of Americans See NASA's Activities as Relevant to Their Everyday Lives

Now think about NASA and how it relates to everyday life – how relevant, if at all, would you say NASA and its activities are to you, your family and your friends?



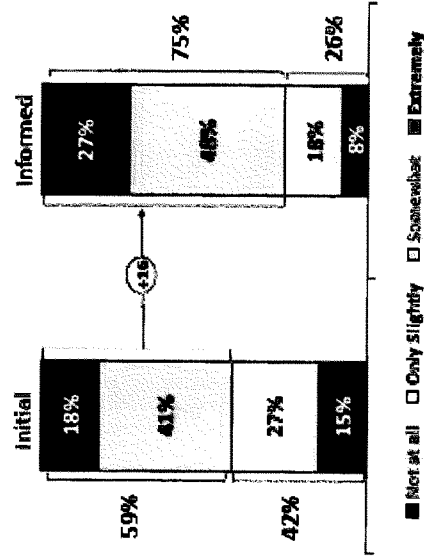
Public Opinion Shift on NASA's Relevance When More Informed – ViaNovo Study (2009)



Study also demonstrated that informing the public will have substantial impact on the public's perception of NASA's relevance.

Information about NASA-Related Benefits Has Tremendous Impact on Personal Relevance Rating

Now think about NASA and how it relates to everyday life – how relevant, if at all, would you say NASA and its activities are to you, your family and your friends?



Public Understanding of NASA's Benefits – ViaNovo Study (2009)



Research provides further insight into limited public understanding of NASA's value.

Few Can Correctly Name Specific Contributions from
NASA-Related Work

Off the top of your head, what's the first product, device or contribution to society that comes to
mind that NASA has helped to develop through its research programs?



Note: The size of one word or phrase reflects the relative frequency of responses. Image was created using wordle.net

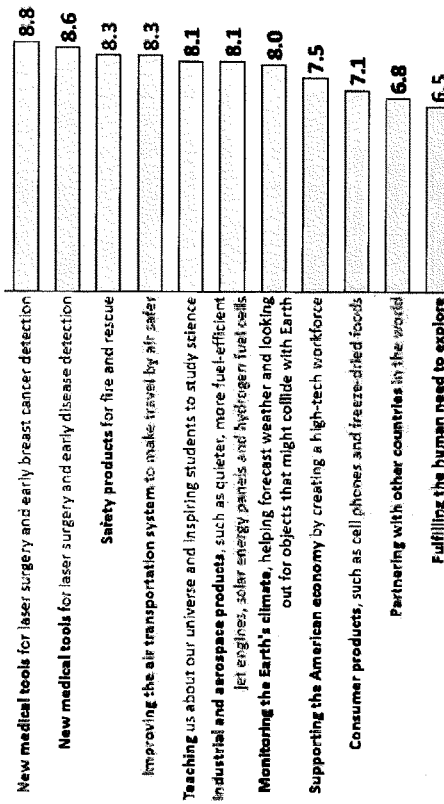
Public Understanding of NASA's Benefits – ViaNovo Study (2009)



Research also delineates benefits viewed to be of value to the public.

Public Places High Value on NASA-Related Benefits, Especially Concrete Safety and Health Contributions

I'm going to mention several products and benefits that have resulted from NASA's programs. For each one, tell me how much or little you value it using a scale from 0 to 10, where 0 means you don't value it at all, and 10 means you value it a great deal.

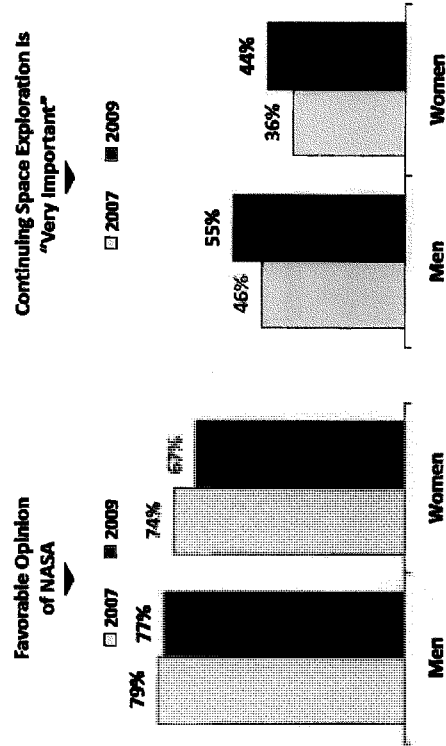


Differences in Public Opinion by Gender - ViaNovo Study (2009)



Research addresses differences of views represented by demographics, including gender.

2009 Gender Differences Similar to 2007





Differences in Public Opinion by Age - ViaNovo Study (2009)

Research addresses differences of views represented by demographics, including gender.

Differences Also Exist Across Age Groups

Key Measure	18-24	25-44	45-64	65+
<i>Total Favorable Impression of NASA</i>	82% ¹	76%	72%	70%
<i>Important to Cont. Space Exploration</i>	88% ²	82% ³	70%	70%
<i>Know Timing of Last Human Moon Landing</i>	12%	23%	30% ³	22%
<i>Excited about Moon & Mars Missions</i>	62%	57%	46%	40%
<i>Need to Eventually Send Humans to Mars</i>	78%	67%	57% ³	52% ³
<i>NASA Economic Contribution (6-10)</i>	68%	52%	56%	49%
<i>Relevance of NASA (initial)</i> ¹	55%	60%	56%	60%
<i>Informed – Initial: Relevance of NASA</i> ²	+4	+17	+17	+14

1 Total combination of all three forms of question (Mars, Moon, Moon & Mars) for those saying somewhat or very excited

2 Measure of Extremity + Somewhat Relevant

3 Measure of change in Extremity + Somewhat

Public view of NASA: Key Conclusions - ViaNovo Study (2009)



- NASA has a great brand, strong public affinity and high support...but your strength is rooted in your legacy accomplishments and heritage
- For the public, NASA = SPACE exploration. Period. End of paragraph. (But they are ready to believe NASA is involved in aeronautics and Earth science).
- The public knows little of what NASA is doing today, doesn't know your mission, and thinks the agency needs to do a better job of communicating.
- The mission to Moon and Mars remains largely unknown and does not captivate public's imagination.
- Communicating how Americans benefit from NASA-related work inspires the public...and increases your relevance, especially among women.
- Learning about gap produces mixed to negative reaction.
- Increasingly difficult to breakthrough to a time-starved public in a cluttered, fragmented media environment...and you lack high-profile champions.



Public view of NASA: Key Conclusions - ViaNovo Study (2009)

In Summary, the Research Findings Reveal Opportunities, Building Blocks, and Challenges for NASA

Building Blocks

- Public image remains strong
- A large majority believes it is important for NASA to continue exploring space
- An increasing number of Americans see NASA's activities as relevant to everyday life
- An increasing number of Americans believe NASA makes a significant contribution to the U.S. economy
- NASA-related benefits and technologies have tremendous impact on perceptions that NASA's work is relevant to their lives

Opportunities

- Most Americans think we need to eventually send humans to Mars
- When informed, Americans place a high value on the benefits of NASA's work, especially concrete contributions to medicine and safety
- Even in these hard economic times, few believe NASA should reduce its work activities
- The vast majority of young adults (19-24 yrs old) feel it is important that we send humans to Mars
- College graduates and the younger generation are relatively comfortable with the plan to buy seats from the Russians

Challenges

- Low awareness of NASA technologies and benefits underscored by fact that most mentioned were Tang, Velcro, Teflon
- Neither the timing of the Shuttle retirement nor the gap issue are widely known to the public
- When hearing about plans to address the gap, few "oppose" it; however, this knowledge does have a demonstrable, negative effect on people's overall opinion of NASA
- Americans' excitement over a moon and/or Mars mission remains muted
- NASA's greatest recent news breakthrough—repair of the Hubble telescope—wasn't very big, in spite of the fact that most Americans say they have seen, read, or heard something about NASA recently

Key Themes and Observations from Studies Over the Past Decade



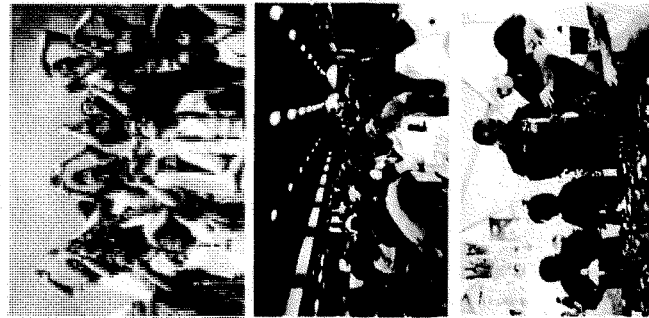
Generally, results from research over the past decade, exhibit the following themes:

View of NASA's image	- NASA maintains a strong brand and image. - Strong reliance on legacy and past accomplishments. NASA has an opportunity to reach a wide range of audiences, but with each generation beyond the Apollo generation, NASA's brand has lost the breadth and depth of its appeal.
Knowledge about what NASA does What we are doing	- Generally, the public views NASA's mission as space exploration. - Inadequate understanding exists of the entire breadth and scope of NASA's mission and work, including contributions to Earth science, space science, and aeronautics research.
Opinion about NASA's direction What we should be doing	- Most Americans believe NASA should continue to explore space. - Mixed support exists for future human spaceflight to the Moon and Mars.
Assessment of NASA's relevance and importance	- Slight majority of the public understands the relevance of NASA's work and results to their everyday lives. - More information has tremendous impact on public view of relevance.
Perspective on NASA's value and benefits	- Public values NASA advancing knowledge to increase understanding of the Earth and space and contributing to increasing the nation's technological capacity. - When informed, public places high value on NASA's benefits including technological advances for medicine, safety and safer/cleaner air travel; monitoring and protecting our home planet; contributing to a high-tech economy; educating and inspiring students to pursue STEM.
Perception of NASA's contributions to the nation's	- Public does not have an accurate perception of the NASA budget. - Even in tough economic times, public indicated interest in NASA support

Telling NASA's Story – Communications and Public Engagement Efforts at NASA Today



NASA continues to capture the public's imagination, reaching a broad and diverse set of stakeholders:



- NASA continues to serve as a leader in social media for the federal government, leveraging the capabilities to rapidly and more directly connect with new sets of target audiences.
- NASA delivers science news and results directly to the public, frequently engaging the world in exciting and compelling results.
 - NASA makes 95 data sets available on its data.nasa.gov site, covering a broad spectrum of information on engineering, space and Earth science. These 95 sites are visited nearly a billion times each year.
 - NASA has been mentioned in more than 1.4 million English-language academic articles since 2002.
- NASA public engagement activities include collaborations, events and activities with museums, science centers, planetariums, observatories, parks, nature centers, zoos and aquariums nationwide.
 - NASA reaches over 1000 professionals at more than 550 U.S. museums, science centers and informal education institutions through the NASA Museum Alliance alone.
- NASA education programs reach and inspire literally millions of educators and K-12, undergraduate, and graduate students nationwide each year
- NASA Visitor Centers engage millions of visitors annually.
 - 1.5 million visitors at the Kennedy Visitor Center complex in 2009
 - The NASA education website was visited more than 60 million times in FY2011, and more than 2 million educational materials were downloaded

Telling NASA's Story – A Sample of Activities Over the Past Year



Curiosity Landing on Mars, August 6, 2012

- 420+ registered landing events with partners and sponsors across all 50 states and 18 countries, including 39 high impact museum events
- More than 6200 stories in 3 month period
- Statistics for week of landing alone: 14M UV on web; 500M media impressions; 17M Facebook impressions; Seven Minutes of Terror video: 8M views; broke NASA record for peak web viewers at 1.2M

Beyond 2012, December 21, 2013

- NASA served as focal point for media and public inquiries
- More than 6,637 stories in the 3 weeks leading up to Dec 21

Asteroid 2012 DA14, February 15, 2013

- Extensive NASA effort to educate the public on the closest flyby ever of a monitored asteroid; live NASA TV/USStream coverage, 62 live shots with NASA scientists, media teleconference, web features and social media presence
- 8,385+ stories in January alone

Landsat Data Continuity Mission Launch, February 11, 2013

- 400+ stories and 907 guests at VAFB (most ever)

SpaceX Cargo Resupply Launch, March 1, 2013

- 563+ stories; NASA's collaborations with commercial entities gain attention

Google+ Hangout – February 22, 2013

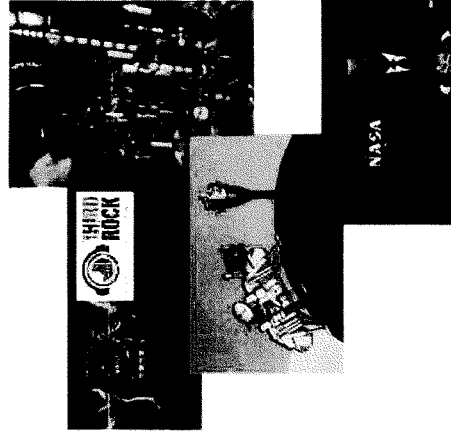
- First ever Google+ Hangout event from space
- Over 32,546 viewers of the Hangout, watching over 141,311 total minutes of the event, with 1,591 people concurrently connected with the ISS

Telling NASA's Story – Leveraging Partnerships with Others



Leveraging Strategic Alliances and Partnerships

- NASA continues work to sustain and build strategic alliances with external organizations to better reach the public.
- Alliances include Lego, Rovio, Third Rock Radio, John Nurminen Events, museums and other organizations.
- Leveraging relationships with industry media, professional/technical advocates and partners has enhanced NASA's reach and ability to engage the public.



Communicating NASA's Story – NASA in the Social Media



- NASA was first federal agency to use Twitter in an official capacity (2008).
 - NASA's flagship account, @NASA, currently has over 4.2 million followers, the most in the federal government.
 - NASA recognized in April, 2013 by Forbes and on Mashable as the 8th most engaged brand
- NASA also was first federal agency to utilize Google+, with almost 1 million circling us.
 - Frequently use Google+ Hangouts to connect with the public and news media through multi-location video engagement.
- NASA Facebook enjoys over 2 million likes
- NASA also has extensive presence on Flickr, YouTube, Foursquare and other tools to connect with the public.
- NASA Socials (formerly Tweetups) engage fans and followers to the next level through behind-the-scenes, in-person experiences that highlight NASA people, missions and programs.
 - In 2013 to date, we have held 14 NASA Social events, inviting 730 social media followers to visit 7 NASA Centers and 2 partner facilities or events.
- NASA social media awards include:
 - 5 Shorty Awards including @NASA, which won for best in government two years in a row; SXSW Interactive Award for Social Media for Mars Curiosity; Webby Award for "Overall Social Presence" for Mars Curiosity, and the Space Foundation's Douglas S. Morrow Public Outreach Award



Recent Efforts Position NASA Communications to More Effectively Reach our Stakeholders

- We are moving toward a more effective **operational and governance model** to facilitate a coordinated approach and shared accountability across the agency for a unified Communications strategy.
 - Communications Coordinating Council (CCC) was established June 18, 2012 as the senior decision-making body for strategic direction, planning, and implementation for NASA's Communications.
 - Communications plans are now required for all NASA programs and projects per recent NPR 7120.5E, with required concurrence by the AA for Communications.
- We have taken initial steps toward building an **integrated NASA Communications portfolio** that incorporates an innovative program to engage the public in participating in, and contributing to, NASA's mission.
 - CCC portfolio development has begun, with recent guidance and waiver submittal/approval under sequestration serving as an initial 'pilot'.



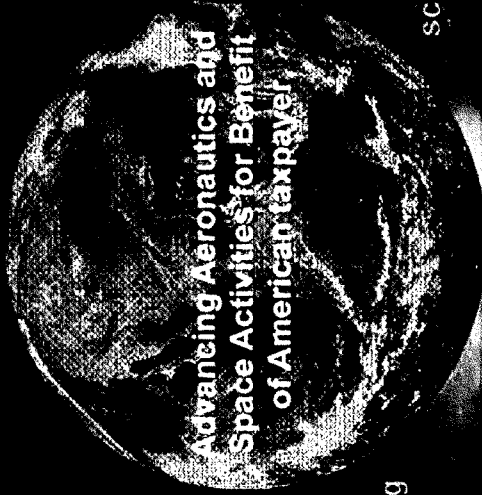
Communications Strategy Key Elements

- Convey NASA's benefits and value to the American people
- Effectively attain public understanding of the breadth and scope of NASA's mission and work
 - Show the vital aspects and linkages between NASA's endeavors in science, human exploration and operations, aeronautics and technology
 - Provide access to the people who do NASA's work
- Communicate the future direction of NASA's endeavors in human space exploration
 - 'Connect the dots' from current human spaceflight efforts to future efforts
 - Demonstrate connections between development of future human space exploration capabilities to science and technology efforts
- Work strategically and leverage resources in order to magnify our reach
 - Includes dialogue under constrained resources re specific target audiences
 - Involves CCC management of Communications portfolio



Articulating NASA's Value and Benefits to Stakeholders is Key to Public Engagement

Advancing U.S. leadership in space exploration and scientific discovery



Advancing Aeronautics and Space Activities for Benefit of American taxpayer

Improving life on Earth and protecting our planet

Strengthening U.S. economy through science and technology investments



Appendix

Relevant Information from Recent Studies Conducted by External Entities

165



Relevant Information from Recent Studies/Surveys Conducted by External Entities

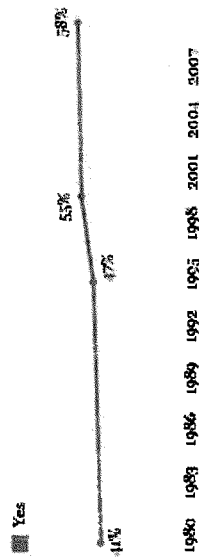
- Gallop poll (July 17, 2009)
 - Results based on telephone interviews with 1,018 national adults, aged 18 and older, conducted July 10-12, 2009.
 - Objective to measure on the eve of the 40th anniversary of the U.S. moon landing, public support of space exploration and government funding of it.
- Pew Research Center for the People and the Press (July 5, 2011)
 - Analysis based on telephone interviews conducted June 15-19, 2011 among a national sample of 1,502 adults 18 years of age or older living in the continental U.S.
 - Survey was conducted by interviewers at Princeton Data Source under the direction of Princeton Survey Research Associates International.
 - Objective to measure on the eve of the last space shuttle mission, public support of space exploration
- Mars Generation National Opinion Poll (March 6, 2013)
 - Targeted a stratified random sample of 1,101 Americans 18 years and older and was taken between February 4-6, 2013. 1,101 respondents representing a 95% confidence level and margin of error of +/-3% answered the survey online. The survey was conducted by email and targeted a nationwide sample. Sponsored by Explore Mars, Inc.
 - Designed to understand attitudes and opinions about space exploration missions, the goal of human space exploration, NASA's budget, and the future of human space exploration.
- Items from other polls/surveys

Gallop Poll - Majority of Americans Say Space Program Costs Justified (July 2009)



On the eve of the 40th anniversary of the U.S. moon landing, a majority of Americans say the space program has brought enough benefits to justify its costs. The percentage holding this view is now at 58% and has increased over time.

It is now 40 years since the United States first landed men on the moon. Do you think the space program has brought enough benefits to this country to justify its costs, or don't you think so?



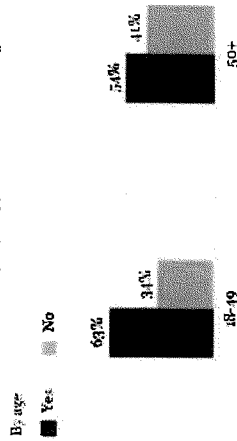
1979 poll conducted by NBC News/Associated Press

GALLUP

<http://www.gallup.com/video/121733/nasa-video.aspx>

Notably, those old enough to remember the historic moon landing are actually somewhat less likely than those who are younger to think the space program's costs are justified. Among Americans aged 50 and older (who were at least 10 years old when the moon landing occurred), 54% think the space program's benefits justify its costs, compared with 63% of those aged 18-49.

It is now 40 years since the United States first landed men on the moon. Do you think the space program has brought enough benefits to this country to justify its costs, or don't you think so?



July 10-12, 2009

GALLUP



Gallop Poll - Majority of Americans Say Space Program Costs Justified (July 2009)

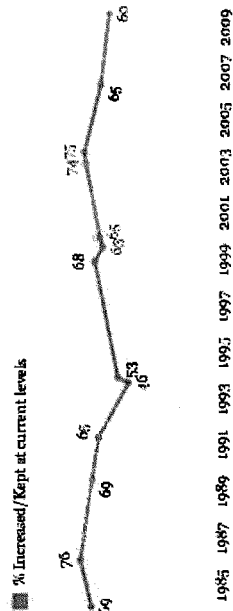
The July 10-12 Gallup Poll also finds that most Americans continue to express support for the current level of funding for NASA (46%) or an expansion of it (14%). But the 60% holding these views is on the low end of what Gallup has measured since 1984, when the question was first asked.

The two lowest readings of 46% and 53% were found in a pair of 1993 polls. In 1993, as now, Americans had highly negative evaluations of the economy, and the results suggest that when Americans have a negative outlook on the economy, they are apparently less willing to spend money for space exploration. In addition to a struggling economy, the lower 1993 NASA ratings are due to a number of problems that plagued the agency, including losing contact with the Mars Observer and several last-minute cancellations of planned space shuttle missions.

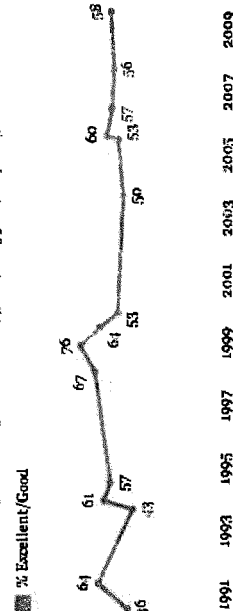
Fifty-eight percent of Americans say NASA is doing an excellent (13%) or good (45%) job. The agency's ratings have been stable over the last several years. The high point was 76% in late 1998 after 1960s astronaut John Glenn made a return trip to space, and the low point was in September 1993.

<http://www.gallup.com/video/121733/nasa-video.aspx>

Do you think spending on the U.S. space program should be increased, kept at the present level, reduced, or ended altogether?



How would you rate the job being done by NASA - the U.S. space agency? Would you say it is doing an excellent, good, only fair, or poor job?

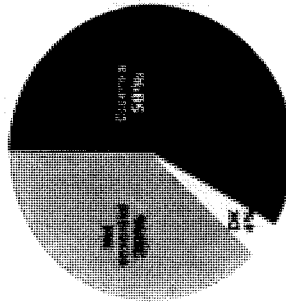




Pew Research Center for the People and the Press – Majority Sees U.S. Leadership in Space as Essential (July 2011)

On the eve of the final mission of the U.S. space shuttle program, most Americans say the United States must be at the forefront of future space exploration. Fifty years after the first American manned space flight, nearly six-in-ten (58%) say it is essential that the United States continue to be a world leader in space exploration; about four-in-ten say this is not essential (38%).

U.S. Continuing to be World Leader in Space Exploration Is ...

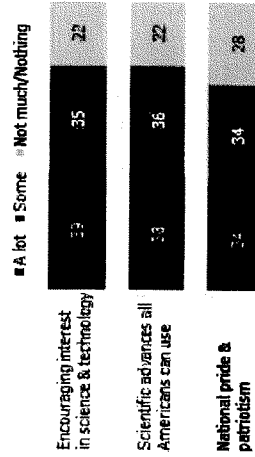


PEW RESEARCH CENTER June 15-19, 2011.

<http://www.people-press.org/2011/07/05/majority-sees-u-s-leadership-in-space-as-essential/1/>

Large majorities say that the space program has helped encourage interest in science, led to scientific advances and contributed to feelings of patriotism. But no more than about four-in-ten say that the program has contributed "a lot" in any of these areas. Overall, 39% say it has contributed a lot to encouraging interest in science, 35% say it has contributed some while 22% think it has contributed not much or nothing. Nearly as many (38%) say the space program has contributed a lot to scientific advances that all Americans can use, while 34% think it has done a lot for feelings of pride and patriotism.

How Much Does Space Program Contribute to ...



PEW RESEARCH CENTER June 15-19, 2011. Q17.



Pew Research Center for the People and the Press – Majority Sees U.S. Leadership in Space as Essential (July 2011)

As the shuttle program comes to a close 30 years after its first mission, 55% of Americans think the program has been a good investment for the country; 36% do not think so. In August 1981, four months after the first shuttle flight, 66% said the program was a good investment.

<http://www.people-press.org/2011/07/05/majority-sees-u-s-leadership-in-space-as-essential/1/>

Mixed Opinions of Shuttle Program among Poor, Less Educated			
	Has space shuttle been a good investment?		
	Yes %	No %	DK %
Total	55	36	9=100
Men	59	34	7=100
Women	52	38	10=100
18-29	54	34	12=100
30-49	55	37	9=100
50-64	55	38	6=100
65+	56	34	9=100
College grad+	66	28	7=100
Some college	57	34	10=100
H.S. or less	47	43	10=100
Family income			
\$75,000+	67	27	6=100
\$30k-\$75,000	57	35	7=100
Less than \$30k	44	47	9=100
Republican	53	28	8=100
Democrat	48	44	8=100
Independent	60	34	6=100

PEW RESEARCH CENTER June 15-19, 2011 Q16. Figures may not add to 100% because of rounding.



Mars Generation National Opinion Poll – Measuring U.S. Citizen Support for the Exploration of Mars (March 2013)

On average, Americans believe that NASA spending represents 2.43% of the federal budget with a standard deviation of 1.68%. Of the respondents polled, 95% believe NASA spending falls within 0.75% and 4.11% of the federal budget. In reality, NASA's budget in FY2011 was \$18.4 billion representing 0.5% of the federal budget.

Indicate whether you "Strongly Agree," "Agree," "Disagree," or "Strongly Disagree" with the following statements:

#		Strongly Agree	Agree	Disagree	Strongly Disagree	# of Respondents	Mean
1	It is worthwhile to increase NASA's percentage of the federal budget to 1 percent to fund initiatives, including a mission to Mars.	31.61%	44.14%	20.25%	4.00%	1,102	1.97
2	The settlement of Mars should be left to privately-funded private sector efforts.	15.53%	32.15%	42.50%	8.81%	1,101	2.50
3	It is necessary for the Government to fund initial technologies to send humans to explore Mars.	23.07%	48.96%	23.43%	4.54%	1,101	2.09
4	If Curiosity, NASA's rover, finds evidence of past or present life on Mars, we should send a human crew to verify the finding.	33.15%	53.15%	12.62%	3.09%	1,102	1.88
5	NASA should strengthen and expand partnerships with the private sector to send humans to explore Mars.	32.15%	51.25%	14.17%	2.45%	1,102	1.87

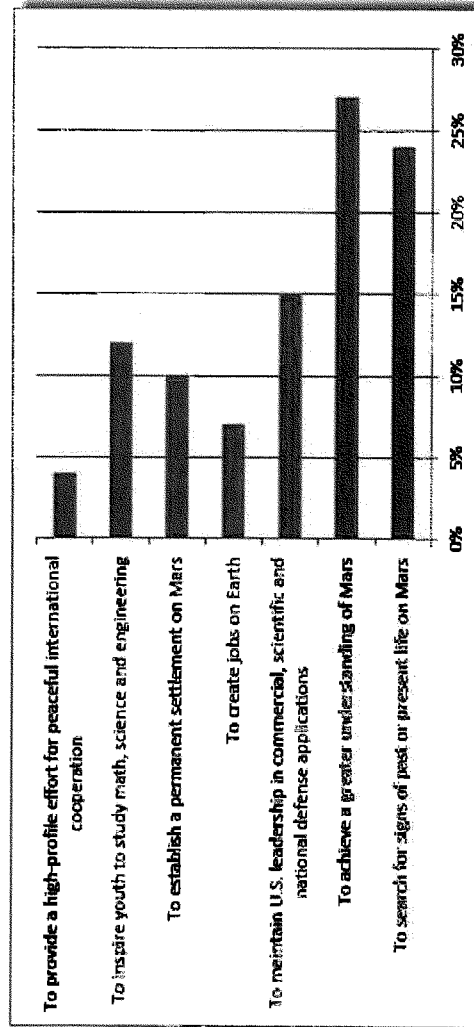


Mars Generation National Opinion Poll – Measuring U.S. Citizen Support for the Exploration of Mars (March 2013)

According to the majority of Americans, the top three reasons for human exploration of Mars are:

- 1) to achieve a greater understanding of Mars
- 2) to search for signs of life
- 3) to maintain U.S. leadership in commercial, scientific and national defense applications.

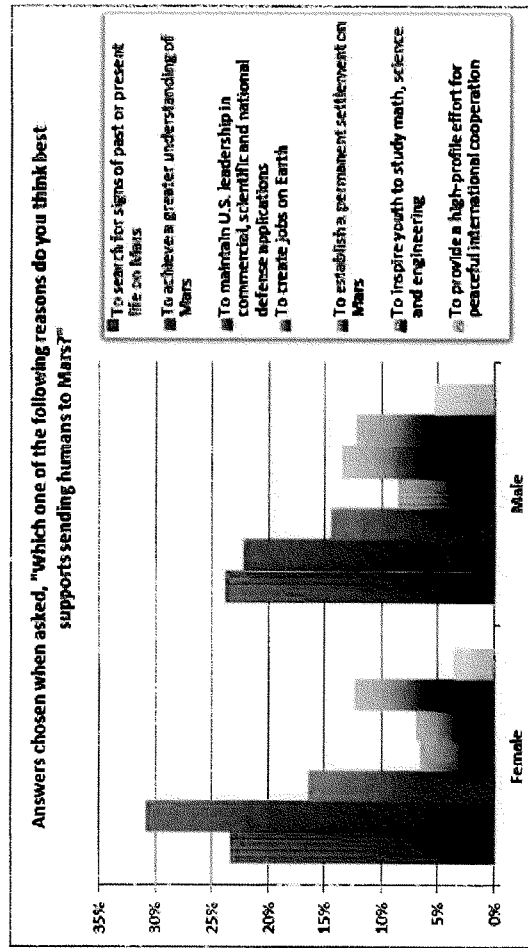
Which one of the following reasons do you think best supports sending humans to Mars?





Mars Generation National Opinion Poll – Measuring U.S. Citizen Support for the Exploration of Mars (March 2013)

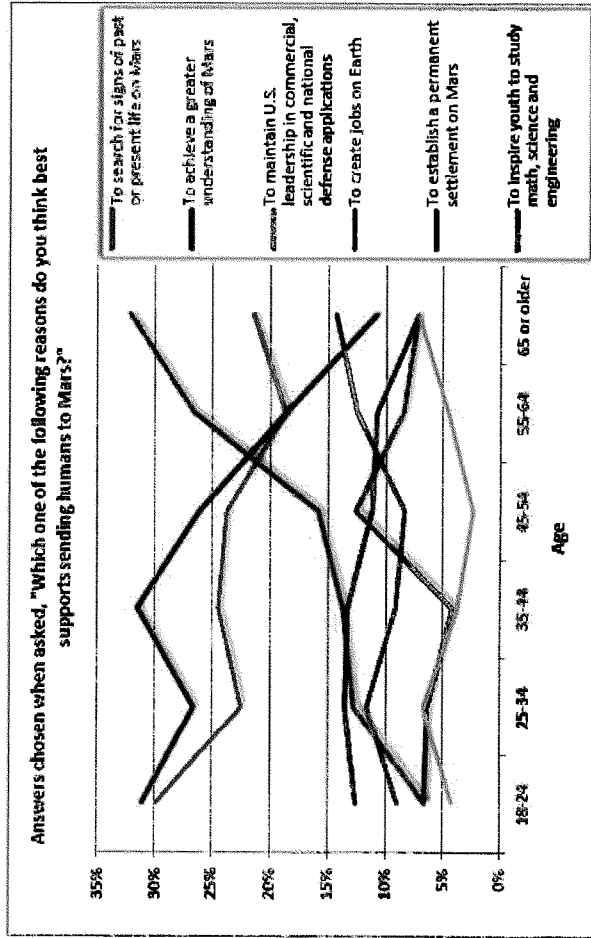
Both sexes had the same top three choices as the population, although more women had their number one and number two choices swapped, placing “to search for signs of past or present life” as first, and “to achieve a greater understanding of Mars” as second.





Mars Generation National Opinion Poll – Measuring U.S. Citizen Support for the Exploration of Mars (March 2013)

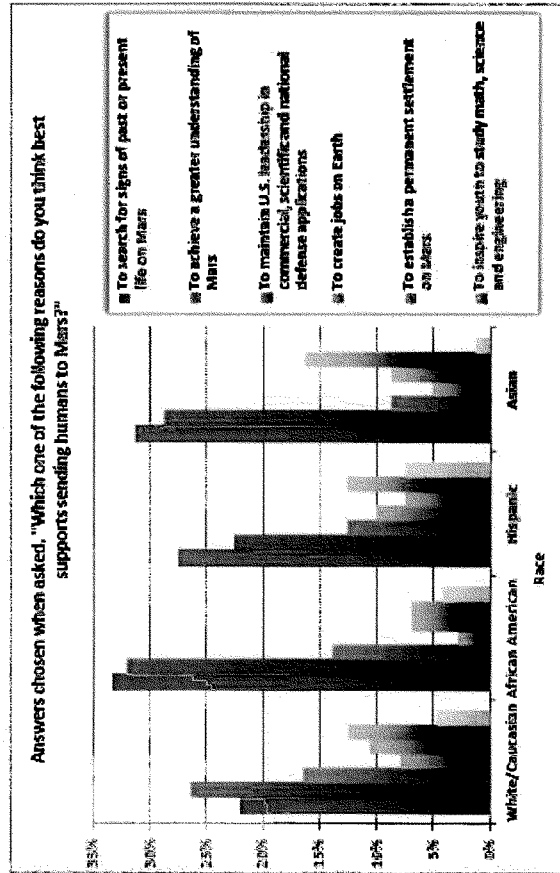
The prevalence of the reason “to maintain U.S. leadership in commercial, scientific and national defense applications” given trended upward with age, with more than 32% of the 65+ age group selecting it as the best support for sending humans to Mars. Less than 7% of those in the 18-24 age group selected that option as the best support.





Mars Generation National Opinion Poll – Measuring U.S. Citizen Support for the Exploration of Mars (March 2013)

Those who identified as White/Caucasian, African American and Hispanic all possessed the same top three reasons supporting sending humans to Mars as the general population. Asians, though, selected “to search for signs of past or present life on Mars,” then “to achieve a greater understanding of Mars” followed by the reason that didn’t make it to other groups top choices, at 16%, “to inspire youth to study math, science and engineering.”





Items from Other Polls and Surveys

CNN/Opinion Research Corporation Poll. Aug. 6-10, 2010. Adults nationwide.

- "All in all, would you say the U.S. space shuttle program has been a worthwhile and important program for this country, or would the money have been better spent in some other way?" N=513 (Form A), MoE $\pm$ 4.5

	Worthwhile, important	Better spent another way	Unsure
	49%	50%	1%

CBS News Poll. July 9-12, 2009. N=944 adults nationwide. MoE $\pm$ 3.

- "Forty years ago, the United States spent a great deal of time, effort, and money to land men on the moon. Looking back now, do you think that effort was worth it, or not?" 8/99: "Thirty years ago . . ."

	Worth it	Not worth it	Unsure
7/09	71%	24%	5%
8/99	71%	24%	5%

- "Since the moon landing forty years ago, do you think the U.S. space program has accomplished more than you expected, less than you expected, or about what you expected it to accomplish by now?"

	More than expected	Less than expected	About as expected	Unsure
7/09	27%	32%	36%	5%

- "Would you favor or oppose the United States sending astronauts to explore Mars?"

	Favor	Oppose	Unsure
7/09	51%	43%	6%
1/04	48%	47%	5%
8/99	58%	35%	7%
7/97	54%	41%	5%
6/94	55%	40%	6%

CONTINGENCY PLAN FOR THE MANNED SPACE PROGRAM

Mr. CULBERSON. And I would like to follow up on Ms. Roby's question and one that Mr. Aderholt asked, but first let me ask you a really important question that I have been meaning to ask, it deals with the manned space program. What is NASA's contingency plan in the event the Russians just say no more flights? Because obviously Vladimir Putin is reminiscent of Joe Stalin, he is very aggressive. We are going to continue to see the Russians attempt to expand their sphere of influence very aggressively and I do not see relations improving any time soon. If the Russians decide to just cancel our ability to use Russian vehicles to get to the International Space Station, what is your contingency plan?

General BOLDEN. Mr. Chairman, it is important for me to state very clearly that while we are always looking at things that could go wrong, when you look at the realities on the ground, the relationship between NASA and Roscosmos remains very strong. Indications are that while our two governments and our political and diplomatic relations are not very good, indications when you look at fiscal dealings, availability of rocket engines, support for the International Space Station, continued support for launching crews and commitment to the International Space Station through 2024. In Russia that comes from the top. So the indications are that the rhetoric on the political side is not the same when you talk about space exploration.

Mr. CULBERSON. Right. And that—

General BOLDEN. However—

Mr. CULBERSON. Right.

General BOLDEN [continuing]. We are always making plans for contingencies should something go wrong.

Mr. CULBERSON. That is my question.

General BOLDEN. There are always—Mrs. Roby mentioned on a bad day, on your worst day, what happens? On the worst day, the Russians decide that they are no longer interested in space exploration and that—

Mr. CULBERSON. Or carrying us to the space station.

General BOLDEN. Mr. Chairman, I know this is going to sound like I have some crystal ball or something. We are an incredibly valuable partner for them, we are an indispensable partner for them in space exploration. If they made a decision that they no longer wanted to carry us to the International Space Station, they have subsequently made a decision that they no longer want to operate the International Space Station. That is just simple. It is because we operate, we are responsible for the day-to-day operations control of the International Space Station. They provide propulsion, but we are planning right now for them to, at some point take away the propulsion module that is there right now and we have other means to do that—

Mr. CULBERSON. But of course one of NASA's great strengths has always been that you plan for the unexpected.

General BOLDEN. Yes, sir.

Mr. CULBERSON. You always have redundant systems on your spacecraft, on the ground, you have the ability to fall back on another system if one fails.

General BOLDEN. Yes.

Mr. CULBERSON. And we need to know, the Congress needs to know——

NASA'S BACKUP PLAN FOR HUMAN EXPLORATION

General BOLDEN. Mr. Chairman——

Mr. CULBERSON [continuing]. What is your plan in the event the Russians say we are not flying Americans to the space station anymore? Please answer that directly. You have got to be planning. I know that Mike Griffin, for example, did not want to fly the mission to the Hubble because the high inclination of the orbit was very different from the space station——

General BOLDEN. That was Sean O'Keefe.

Mr. CULBERSON. Sean O'Keefe.

General BOLDEN. I apologize for interrupting——

Mr. CULBERSON. No, no, make sure I got it right.

General BOLDEN [continuing]. But I do not want my friend Mike Griffin to get——

Mr. CULBERSON. I vividly remember the Hubble needed to be serviced, but the concern was that if there was a problem we could not rescue those astronauts. And the agency always has a backup plan. So if you could, please, sir, tell us specifically what is your contingency plan? What is NASA's backup plan in the event the Russians say we are not flying Americans to the space station? Tell us you have one.

General BOLDEN. Mr. Chairman, because this is a partnership and because Russian crew members would be equally at risk, our backup plan, if you want to talk about that, would be to mutually agree that the space station and space exploration is going to come to an end.

Mr. CULBERSON. So you have no backup?

General BOLDEN. We would make an orderly evacuation of the International Space Station. We have six seats, six crew members, all six guys. If you wanted to say, what happens on a really, really, really bad day? That the nations of the world decide that we are done with human space flight. You are forcing me into this answer, and I like to give you real answers and I do not want to try to BS anybody. If the nations of the world decided that human exploration is done, we have the capability to bring all six crew members home, because we have two vehicles, six seats, six crew members. That day——

Mr. FATTAH. That are on the space station now.

General BOLDEN. That are on the space station.

Mr. FATTAH. Right. So we could evacuate the station if we need to.

General BOLDEN. I do not anticipate that that day is going to come. I am not worried about getting people to the International Space Station as long as the Congress funds the President's budget at \$1.2 billion in 2016, because we will have an American capability to get crews to the International Space Station. Getting them there is not the issue right now, or getting them back is not the issue.

Mr. CULBERSON. I know we have got the ability to get them back, but——

General BOLDEN. Getting them there. But that is the only issue, Mr. Chairman.

Mr. CULBERSON. I urge you, it is vitally important that NASA have the—are you making contingency plans? Have you got people working on what if?

General BOLDEN. Mr. Chairman, may I make sure I understand your question?

Mr. CULBERSON. Yes. So how do we continue—in the event the Russians say we are not carrying anybody else to the space station, your only plan is to evacuate it?

General BOLDEN. No, sir. And I thought I might confuse people. Let's take two things. Is the question what is the contingency plan to get people to the International Space Station, to get crews there?

Mr. CULBERSON. I understand we can evacuate folks, that is always essential. We want to make sure we can rescue people, you have got a lifeboat capability to get them home. But if the Russians said they are not carrying Americans anymore to the space station before commercial reaches full capability, you have no backup plan to continue to fly Americans to the space station until the commercial folks get up and running?

General BOLDEN. Mr. Chairman, that is the plan.

Mr. CULBERSON. But you do not—

General BOLDEN. Mr. Chairman, there is no capability to get anyone to the International Space Station today—well, there are two ways, but I do not use one—and that is Soyuz. That is the capability, that is the only capability any nation in the world has. So, to talk about what is the backup plan, what is the contingency plan, the backup plan, the very serious backup plan is to get moving and get Boeing and SpaceX certified, so that we can fly in 2017. That is the backup plan. Had we gotten the funding that was requested when I first became the NASA Administrator, we would have been all joyously going down to the Kennedy Space Center later this year to watch the first launch of some commercial spacecraft with our crew members on it. That day passed. I came to this committee and I said over and over, if we do not fund Commercial Crew—

Mr. CULBERSON. Had NASA not cancelled the Constellation Program, we would be ready to fly within 12 months.

General BOLDEN. Mr. Chairman, that is not correct.

Mr. CULBERSON. If we—

General BOLDEN. And, Mr. Chairman, whoever told you that, that is not correct.

Mr. CULBERSON. It set us back.

General BOLDEN. Mr. Chairman, any time you interrupt a program, it sets the nation back. So that is very true.

Mr. CULBERSON. Regardless of who is the President and regardless of who planned it, it was just a setback. I just wanted to establish it for the record and turn it over to my good friend Mr. Fattah. But it is a deep concern that we do not have a contingency plan to get our folks up in the event that the Russians—

Mr. HONDA. Would the Chair yield just for a real quick second?

Mr. CULBERSON. I am going to go to Mr. Fattah, it will be his time.

Mr. FATTAH. Thank you, Mr. Chairman. I will yield for a second.

FUNDING FOR THE SPACE PROGRAM

Mr. HONDA. Just real quick. I think we have to own the question that you are asking that if we want those kinds of things to happen we have to fund it. We have not funded it. I have been here 15 years, we have been cutting every year research and development, the kinds of program we had at NASA.

RUSSIA AND THE ISS PROGRAM

Mr. FATTAH. Right. So first and foremost, just to put this in context and not to belabor it, in terms of the space station for a large period of time, even when we had the shuttle, the Russians took astronauts to the space station, we used the shuttle to take cargo; is that correct as a general matter?

General BOLDEN. After we lost Columbia in 2003, the conscious decision was made because the Columbia Accident Investigation Board said, get space station completed. We worked with the international partners and decided the most—

Mr. FATTAH. What I am saying is that—

General BOLDEN. But we did carry crews, but we carried the construction crews.

Mr. FATTAH. Right.

General BOLDEN. And we said we would use—

Mr. FATTAH. But the main way to get individual astronauts was through the Russians.

General BOLDEN. Yes.

Mr. FATTAH. And when we had the problem with the Russians and Georgia's independence and the military in Chechnya, was there any interruption in our interactions with Russia at that time?

General BOLDEN. No, sir.

Mr. FATTAH. Right. And now we have this new dustup around Ukraine, which is more than a dustup, you know, but it is a similar kind of issue. Has there been any interruption in Russia's cooperation with their part of this partnership?

General BOLDEN. No, sir.

Mr. FATTAH. Right. So now they have also taken a decision this week that they want to extend the life of the International Space Station. They are late to that decision, but they have said something that is useful in that regard. But in the meantime the Administration took some action, right? Because this dismantlement of the shuttle was always going to—putting the shuttle to rest was always going to create this break in our ability, this was known before this Administration came into being. Well, it is being resolved through the ingenuity of American enterprise, because the Administration with the Congress has made a package of decisions about deep space human flight, Commercial Crew and low Earth orbit, and the investment in space technology, so that we can keep our preeminence in space, right? So that is where we are headed.

I wanted to get back to this 238 plutonium. So when we close the Savannah plant—and I am shifting gears now, I went back to where we started at, right?

General BOLDEN. Yes, sir.

PLUTONIUM-238

Mr. FATTAH. When we closed the Savannah plant in '88, we got out of the plutonium business, we got to somewhere around—when you were in charge we had 35 kilograms of plutonium, the DOE says we are going to get something done at Oak Ridge. I went out to visit the plant at Oak Ridge and they have a \$50 million contract with NASA to do this. In the meantime, we also have a problem on the medical side of this with isotopes, which we do not have any domestic capability in this regard either, and the Department of Energy has launched an effort in that regard. But this is very important, because if we are going to power spaceships, we need this plutonium, right? So I just wanted to clear up the record, it is Oak Ridge. And we need to keep mindful of these connections between the subcommittees, because you can speak to your colleague to make sure that that program is robust. Right. But I thank you, we do not have to get into it.

The bottom line is, we are in the lead now. Our lead is not absolute, it is relative. And if we want to stay in the lead, we have got to make these investments or, as some of my colleagues would say, we have to spend—because they get concerned if we use this word investment—spend money, because we cannot lead the world on the cheap. But thank you very much.

General BOLDEN. Thank you.

CONTINGENCY PLAN AND FUNDING

Mr. FATTAH. And I yield back to the Chairman.

Mr. CULBERSON. You know how committed our committee has always been, we have always made sure to plus up and protect NASA's funding levels. And my mention of the cancellation of the Constellation, it is not political, it is a setback, no matter who is in the White House. And it is a real concern, the gap is a real concern. And I wish we did have a contingency, I wish there was some way for us to get there more quickly, and we will certainly do our best to help you do that.

I recognize Mr. Honda.

Mr. HONDA. Thank you. And I share your concern, but I just think that, you know, part of the problem is that we have to fund these kinds of activities because the investment that we make comes back in many ways in terms of the return on the investment. And I think the subcommittee, we may have to be more adamant with the process of the authorization part, you know, I am just saying. On the International—

Mr. FATTAH. This is the way we are going to work this. I am going to work hand-in-hand with my Chairman and we are going to walk this mile together. And I think at the end of the day, there is one thing I am sure of, NASA is going to be in a better position than it otherwise would be.

Mr. HONDA. All right. And on that, I love the Europa mission and I think that—

Mr. CULBERSON. That is music to his ears.

EUROPA CLIPPER MISSION

Mr. HONDA. And, you know, with that kind of probe that we want to be sending up there, we will have new insights on how our solar system has been formed and the environment on this icy world, and possibly even a probe for the potential for alien life down there. Perhaps not the way we know it, but there may be another form of alien life there. So the secondary payloads offer relatively—is relatively cheap, a low-risk opportunity for dramatically increased scientific capabilities of that mission. The secondary payload on the Europa mission could be used to fly through its geysers and water plumes to directly search for life in the plumes and under the surface.

So what are NASA's plans to use secondary payloads on the Europa Clipper mission to hunt for that alien life?

General BOLDEN. Congressman, I am going to take it for the record to get you a formal response. However, what really excites me is the mission to Europa has excited people all over the scientific community, because the geysers of which you speak, if I am correct, I think were first sighted by Hubble. But they are not repeated, so they are not consistent. So we are not sure that, we can—if you are going to send a secondary payload in to fly through a geyser, then you need to know when it is going to geyse. That is a word I just made up. [Laughter].

We do not know how to figure that out just yet, so we are studying. The planetary scientists are really trying to help us understand, is there another instrument that gives us a better idea of their frequency because what you would like to do, and a college student could do this, was take a CubeSat. They call them swarms. So with a mission that you sent to Europa, whether it is the Clipper or anything else, you drop swarms off, and they just go down near the surface. Where you would not send a spacecraft there because the harsh radiation environment, it would not survive, you send these little CubeSats through, and they take all kinds of samples.

[The information follows:]

EUROPA CLIPPER MISSION

At this time, nine instruments for NASA's Europa mission have been selected. The instrument suite seeks to investigate whether Jupiter's moon, Europa, could harbor conditions suitable for life and includes instruments that could examine particles ejected from Europa, such as plumes. Conceptual designs for a potential secondary payload will be considered during the mission's early formulation.

Detailed information on the selected instruments can be found at: <http://www.nasa.gov/press-release/nasa-s-europa-mission-begins-with-selection-of-science-instruments>.

Mr. FATTAH. And I hope return one to Earth.

General BOLDEN. So I think that is what you are talking about. And that is really exciting when you think about it. But that, again, is like everything, it comes from science and technology funds, and those are the funds that we continue to cut.

EVOLVING ISS INTO LEO COMMERCIAL MARKET

Mr. HONDA. And so we need to bolster it and to be able to move forward in areas that we want to move forward on. Determine

through the Chair, and that is the start of the dialog with industry about how it may transition the International Space Station from a pure government operation to partial commercial ownership in this operation. Can you tell us today about what your plans are? And I understand that Russia's obligation is to 2024, so can you just give us some sort of explanation of what the plans might be?

General BOLDEN. I will make it very quick. We were disappointed. We went out with a request for information from the industry, academia, everybody, that said we would like to use the International Space Station. I mean, it is only going to be there for a certain amount of time.

Mr. HONDA. Yeah.

General BOLDEN. We would like for you to look at it and tell us how this gives you confidence that you can go off and position modules or other independent entities in low Earth orbit. This is the infrastructure that I talked about. Everybody said for the most part, "Yeah, nice idea, but we like going for free. We like having NASA do it, and so we're not quite ready yet." We continue to pursue that however, because we think that with the discoveries that are being made now through CASIS, (a non-profit entity that we have put in place to help us go out and recruit people to fly on the International Space Station), that industry, academia, international partners will begin to see the value of not flying on the International Space Station, but what being in a micro-gravity environment provides. So we just have to be patient, but it was disappointing the first time we tried to do it.

RUSSIA'S LAUNCH SITE RELOCATION

Mr. HONDA. Very quickly, in the line of the Chairman's question, I understand Russia is sort of winding up their activities in Kazakhstan as a launch area, and they are going to move back to Russia. How does that impact our programs, and do we have a plan around that?

General BOLDEN. It is like everything else, where we purchase a service. The service is getting our crews to orbit, and it makes no difference whether they launch from Siberia or whether they launch from Kazakhstan. It's a trip that the crew has to take, and that will not change. The crew lives and trains in Star City for long periods of time, and they have to get on an airplane and fly down to Kazakhstan three days prior to the launch. But it is the same thing we do in America. The crew trains and lives in Houston, and they get on an airplane three days ahead of time, and they fly down to the Kennedy Space Center.

LOW EARTH ORBIT

But can I go back to the—because I don't want to leave anyone mistaken—when we talk about science and technology, the point that you made, it is critical, and we have to find better ways to encourage industry and other entities to want to be in low Earth orbit.

We are going to fly what is called a Bigelow Expandable Activity Module (BEAM). It is a Bigelow. It is not inflatable. Mr. Bigelow would get really upset if I say that. It is an expandable module. This is an American entrepreneur who has had dreams of putting

stuff in space for probably 30 years, and has the hardware in place if we can just find a way to get it there. So he has two modules that have been on orbit for more than five years now that were flown up on Russian spacecraft with no instrumentation. So we can look at it. We can see that they are still existing. We have no idea what is in it, whether the air is clean or whatever. We are going to take one of his smaller expandable modules and put it on the International Space Station later this year, and the crews are going to be able to go in and put logistics in there, play with it, do whatever. What we are hoping is that there will be other companies like some of these that are sitting on the back row over here—I will put them on the spot—who will say, “That is a good idea. We want to do that also,” and either buy a module from Mr. Bigelow or go build their own module and put it in another orbit. It does not have to be in the same orbit as the International Space Station.

Mr. HONDA. I think they should buy one from him. I mean, if he has put out 30 years of effort in it, he should get a pay off, you know.

Mr. BOLDEN. I don’t know whether—

Mr. HONDA. Anybody who builds their own, do not come see me. You know?

General BOLDEN. He has built his own, and it has been a while. But that is what, Mr. Honda, that is what we have to do, and so we are taking the risk. We are saying we will fly you to the International Space Station, and we are going to put you there and then we are going to work with it and see what happens. Our hope is that other companies will see that this is a potential moneymaker, and they will take it and move off somewhere else. So I did not want to go without making a note that we were doing things.

Mr. CULBERSON. Thank you. General Bolden, I want to go back to the SLS.

General BOLDEN. Yes, sir.

LAUNCH ABORT SYSTEM AND THE SPACE LAUNCH SYSTEM

Mr. CULBERSON. Because I am concerned about the announcement that there has been slip in the launch date. There has been a delay. NASA has announced a delay in the second round of testing, a launch abort system. And the second round of testing looks like it is going to be held in 2018. I know that the budget request that the President submitted to the Congress asks for a 12 percent reduction in Orion and SLS funding, which concerns me because we have obviously got a serious deficiency in the ability to reach low Earth orbit. We certainly do not want to see any slippage in our ability to go beyond low Earth orbit, and I want to make sure the SLS program is robust, and that it achieves all of its milestones. We would like to get it in ahead of time.

Could you talk to us about what is necessary, what does this subcommittee and the Congress need to do, to help the SLS prevent any more slippages? What can we do to help make sure there are no more slippages? Why was the first launch slipped by a year?

General BOLDEN. Mr. Chairman, if I can address the launch abort system first. That is not a part of SLS. That’s a part of Orion, and your statement is a surprise to me. I will take it, for the record, I will have to go back and find out. My impression, my in-

formation, was we were getting ready to do the test of a part of the launch abort system, at least the motors, right over in a facility in Maryland sometime this year. But I will go back and verify where we are there. So that had no impact on anything about SLS.

What got us to where we are with SLS today when we say 2018 is its readiness to fly, was we went through the very formal process of milestone evaluations and everything, and when that was presented to Robert Lightfoot at a formal session that we have on programmatic decision making, then it came out that we, on our funding profile, SLS would be ready in 2018 at a certain price. And so that was the first time that we really knew for certain what its earliest launch date could be. But that is only SLS in the ground system.

[The information follows:]

Space Launch System

We have identified our Agency Baseline Commitment for the SLS and EGS, which supports a launch capability readiness date of November 2018 at 70 percent and 80 percent Joint Confidence Level (JCL), respectively, to the EM-1 launch readiness date. NASA will establish an Orion launch capability readiness date as a product of its Key Decision Point-C review in the third quarter of FY 2015, though the formal baseline for Orion will be for development through Exploration Mission-2 (EM-2). The integrated launch date for EM-1 is to be determined after all three programs complete their Critical Design Reviews (CDRs). The integrated launch date for EM-2 would be set following the EM-1 mission. The FY 2016 President's budget request provides the funding level needed to keep the Space Launch System (SLS), Orion, and Exploration Ground Systems (EGS) on track for the first integrated launch of Exploration Mission-1 (EM-1).

Slated for FY 2019, the Ascent Abort-2 (AA-2) test – part of the Orion Program – involves testing the abort and attitude control motors of the spacecraft. In the event of an emergency during launch or climb to orbit, Orion's Launch Abort System would activate within milliseconds to propel the crew module away from the launch vehicle to safety. The abort system also provides a protective shell that shields the crew module from dangerous atmospheric loads and heating during ascent. Once Orion is out of the atmosphere and safely on its way to orbit, the spacecraft will jettison the system. The AA-2 test is part of the flight test plan supporting the first crewed SLS/Orion mission, EM-2, in FY 2021-2022. Since the AA-2 test supports EM-2 rather than EM-1, the scheduling of this test for FY 2019 does not impact the integrated launch date for EM-1.

Mr. CULBERSON. Okay.

General BOLDEN. That is what we are saying.

Mr. CULBERSON. And earlier I thought I heard you say at one point that an initial launch capability would be late 2018, and then I thought I also heard you say after 2018.

General BOLDEN. Mr. Chairman, what I may have said, I may have confused things by referring to the system. I do not talk about launch of SLS. I talk about the launch of the integrated SLS and Orion to cislunar space. That means it is going to be EM-2. So that is what, when I talk about important, really important dates, because that is the way we are planning Orion. We are planning a launch availability of Orion for EM-2. Then we back away from that to say when EM-1 can be launched. You know, we are trying to figure out what is the earliest possible date that we can fly a human-rated mission on SLS and Orion. Once we determine that—and that is what will come to you all this summer.

Mr. CULBERSON. Okay. This summer you will get that to us?

General BOLDEN. The technical term for it is “key decision point two.”

Mr. CULBERSON. That’s—

General BOLDEN. Key decision point C.

Mr. CULBERSON. Okay.

General BOLDEN. So KDP-C. And that will not be until this Spring or Summer. And once that occurs, we will come back in to you and say, “Here is the decision from KDP-C.”

Mr. CULBERSON. And NASA has told the subcommittee that increasing the fiscal year 2016 budget for SLS would not result in an advanced schedule or reduced life cycle cost for the program, and yet you have requested a 12 percent reduction in funding for Orion and SLS. That seems a little inconsistent. It seems to me we are not adequately funding SLS and Orion. How are you going to manage to stay on track if you are asking for a 12 percent reduction?

General BOLDEN. Mr. Chairman, we think we are asking for adequate funds. We have a schedule that is built around what comes out of the key decision point milestones. The budget that we have in place today supports having the SLS, the launch vehicle, and the ground systems available in 2018, the present budget that we have in place today. We will have a budget request, that will be refined next year once we get the KDP-C for Orion, and I hope I am not confusing things here, but I will get clarification back to you.

Mr. CULBERSON. So you anticipate you will be able to give us an estimate of your first crewed mission by this summer?

General BOLDEN. Yes, sir.

DECADAL SURVEY PRIORITIES

Mr. CULBERSON. Okay. Let me talk a minute about the Decadal survey priorities and see if my friend, Mr. Fattah has any follow up, we will probably submit the bulk of these for the record. The reason the Europa mission is so important is that it was the top priority of the Decadal survey last decade and the second priority this decade. And it, as you know, holds two to three times more liquid water than all the water on Earth and is the most likely place beyond Earth that if we are going to find life, it is most likely right there in our own backyard. That is why the planetary science com-

munity is so excited about it and why this committee has supported it so strongly.

The mission is still in its early planning phases, but I would like to know, if you could, talk to us about the Decadal survey in general. Are you satisfied that NASA is following the direction of Congress in funding and flying the top priority of the planetary Decadal survey? And talk to us about some of the other Decadals. To me, that is the gold standard. That is what NASA should be flying, the best recommendations of the best minds in the scientific community, whether it be planetary, heliophysics, earth science, or astrophysics.

General BOLDEN. Congressman, or Chairman, the best thing out of Decadal surveys is the fact that it does represent the thinking of the best minds in science, if you will, out of the National Research Council in a specific discipline. What we endeavor to do is follow the guidance of the Decadal survey, and we generally try to focus on the number one and number two areas there. We do not go down deep into the list, because the Decadal surveys give us multiple projects that can be flown.

As the way the planetary said this past time when Steve Squyres chaired it was, in fact, he made it very specific. The Decadal survey was very clear. If NASA is going to fly a subsequent Mars Rover after Curiosity and it is not going to cache, then don't do it. I mean, they were very specific. Go to Europa. It did not say to go to Europa and do this. But we have decided that we can put enough funds in the budget to mount another charge on Mars with Mars 2020, which we intend will be a caching mission.

Mr. CULBERSON. Yeah. The first step on that——

General BOLDEN. We will put samples in place——

Mr. CULBERSON. Right.

General BOLDEN [continuing]. For a subsequent return to Earth and begin the formulation of a Europa mission. That is what we are doing. I hate the term robust, but in general terms, if you look at our planetary science program, Dawn is closing in on Ceres. We are still learning from the abundance of data that Dawn gathered in its year orbiting Vesta. New Horizons is closing in on Pluto and is already imaging Pluto. Juno will arrive at Saturn soon, and so—Jupiter, not Saturn, thank you very much.

Mr. CULBERSON. Yeah, I thought that——

General BOLDEN. No, no, no, that is, yeah. You are right.

Mr. CULBERSON. It is Jupiter.

General BOLDEN. But every planet and major dwarf planet in our solar system is either being investigated presently or going to be investigated in the next two years. I know there are people who believe we can do better than that, but I am not sure we will make the planetary science community happy if visiting every planet in the solar system is not good enough. We are now talking about understanding planets in other solar systems and other galaxies thanks to the work of Kepler. So we are expanding the areas of investigation for planetary scientists even beyond our own solar system. I think that is good. I think it is great. Whether it satisfies everybody or not, no it does not, and we never will. But it is like how much money do you need? It does not make any difference how much money you give me, I am going to tell you I need more.

Mr. CULBERSON. Well, this was the first Decadal survey I think they had ever done where they used independent outside cost estimates. Steve Squyres was very adamant and quite correct in making sure that we had realistic outside independent cost estimates on each one of those missions so that Congress would have a good idea of what they would actually cost.

Mr. Fattah, any follow up?

RANKING MEMBER CLOSING REMARKS

Mr. FATTAH. Just a closing comment, not a follow-up question. One is, I want to thank the Chairman, and I think the time clock thing is working. Except for me and you, it has been working great. And I want to thank the Administrator, not for all that you have done in terms of space exploration, but what you are doing in terms of preparing future generations.

The Space Act Agreement with the Boys and Girls Clubs of America, four million young people, four thousand clubs all across the country, in getting these young people excited about STEM education in general, but doing that through having them learn about the exciting work of NASA, because that is how we get people who want to be mathematicians and engineers and everything that we need by getting them excited about this.

And I said this to the Chairman in private one day that all of us do not have the benefit of having, you know, Cape Canaveral or NASA Mission Controls in our district, but all of us have these young people who want to live up to their God-given potential, and NASA is the best opportunity to get these young people excited about learning. So I want to thank you for all you have done.

General BOLDEN. Absolutely.

Mr. FATTAH. Thank you, Chairman, I yield back.

Mr. CULBERSON. Mr. Honda, any follow up?

PUBLIC/PRIVATE PARTNERSHIPS

Mr. HONDA. Thank you. And in the words of Leonard Nimoy, live long and prosper. And if I may just ask one quick question, I was really—

Mr. FATTAH. That is more of a comment.

Mr. HONDA. I know, but I could not resist. I just wanted to share that, you know. I was really pleased to see NASA moving forward with the competition-based cargo and commercial crew. And I think that we are really concerned about that as a group. Now that contracts with the Boeing and SpaceX are in place and there is a clear path forward to restoring domestic crew space transportation by 2017, under-funding this program will delay crew flights and lead to continued reliance on Russia for access to the International Space Station. So as a commercial crew provider's focus on low Earth orbit, NASA would be able to shift its focus into deeper exploration of space.

Can you just briefly discuss how the success of this public/private partnership is shaping how NASA would be using future missions to explore the solar system, and how do you envision more cooperation with the private companies to explore resources on the moon and near-Earth asteroids?

General BOLDEN. Congressman, we have always felt that collaboration with private industry and entrepreneurs was the right way to go. Commercial crew and cargo, commercial cargo particularly, has demonstrated that that was in fact a good plan, a good thing to do. We are now looking at collaboration with industry and academia and entrepreneurial interest in putting things on the surface of the moon. I tell people all the time that we never left the moon. We have always been there. We have orbiting vehicles right now, but in the near future, and near is a relative term, my hope is that we will enable humans to go back to the surface of the moon. NASA does not have to be the organization doing it if we are implementing it and supporting it.

We are going to be operating in cislunar space for ten years at least when we go to the proving ground. With multiple term trips back and forth to cislunar space, I think it is inconceivable to me that we would not partner with some entrepreneurial interest, or some industry, or some other international partner who wants to build a Rover and, lower it to the surface of the moon from the cislunar orbit in which we happen to be. It is inconceivable to me that that will not happen.

Mr. HONDA. It could be like expanding internet, you know, going to space and be that kind of thing. So, again, Mr. Chairman, live long and prosper.

Mr. CULBERSON. Okay. Thank you, Mr. Honda. There is no prohibition in current law against private companies mining——

General BOLDEN. Oh, I do not, Mr.—I get asked that all the time, and I need to find an answer. I do not——

Mr. CULBERSON. I do not believe there is. I think, of course, no nation——

General BOLDEN. I do not think there is, and that is the problem. Everyone is concerned, and so one of the fastest growing areas in the field of law today is space law.

Mr. CULBERSON. Well, no nation can claim sovereignty over a asteroid or the moon.

General BOLDEN. I think you are right.

Mr. CULBERSON. I think that we treat it just like Antarctica, however, though——

Mr. FATTAH. Well, no nation except if we claim it, right?

CHAIRMAN'S CLOSING REMARKS

Mr. CULBERSON. I do think Mr. Honda raises a really interesting, good question that I think maybe in the future we need to think about NASA providing infrastructure and support to the private sector to reach out, and whether it be mine resources, make those resources as fuel stations for missions out to deep space in the same way the highway department provides infrastructure for commercial activity on Earth in the future.

But we will certainly do everything we can to support you, and it is a real privilege for me to be in this position to help make some of those dreams of the future, of young people come true, Mr. Fattah and Mr. Honda, and something we have always worked together arm in arm in a bipartisan way.

I have got a lot of questions I will follow up with you personally on as well as for the record. But it is a real privilege for me to be

chairman of this subcommittee. And I hope as part of my legacy that I will, working with Mr. Fattah, find a way to make sure that NASA's budget request comes directly to us, you know, to bypass Office Management and Budget. We ought to hear directly from you as to what you need. We ought to give you the stability and support you need to do multi-year procurement so that you can build spacecraft and rockets the way the Navy builds aircraft carriers and submarines. Mr. Fattah?

Mr. FATTAH. I like the way you think, Mr. Chairman.

Mr. CULBERSON. We—

Mr. FATTAH. Directly to us. That is—

Mr. CULBERSON. We really do. We want to hear directly from you, and I hope also as a part of my legacy, our legacy together on this, I really want to see NASA focusing on those Decadal surveys. I really think that is the proper map, guideline, for future missions, relying on the best minds in the industry.

It is the law today that NASA follow the planetary Decadal survey. I would like to work with you, Mr. Fattah, in trying to expand that to help make sure that NASA is following the recommendations of the Decadal surveys in heliophysics and earth sciences and astrophysics as well.

And when it comes to the manned program, that is a bigger challenge, is how do you do a Decadal survey?

Mr. FATTAH. I will say this publicly, Mr. Chairman, I love the fact that there could be, one, a leadership role, someone on the other team, that says you want to focus on science as the guidepost. So it works for me. All right?

Mr. CULBERSON. That is it. That is my North Star, is to make sure that we are following the recommendations of the best minds in the scientific community in each one of these areas of specialty.

And then also I hope to not only to make sure that we get the SLS up and running, and get commercial up to low Earth orbit, but for the long term, I just want to leave you with this. I actually really think the asteroid redirect mission—I would encourage you to focus on the development of the next generation of rocket propulsion. That, to me, is the great value of that mission. The fact that we are still flying a rocket engine that has fundamentally been designed by Robert Goddard in the 1920s is just inexcusable.

And the asteroid redirect mission, the great value there is that for these young people that NASA touches and inspires, I really hope it is part of my legacy in the time that my district continues to rehire me, that I am privileged to chair this subcommittee, that not only will we leave NASA with a robust low Earth and deep space, manned space flight capability, and a robotic planetary astrophysics/heliophysics and earth science program designed and recommended by the best minds in the industry, but also to leave for future generations development of the first interstellar rocket propulsion system that would carry us to Alpha Centauri and beyond.

That can be done. It is within the realm of our ability, within the realm of the capability of the brilliant men and women that work for you, General Bolden. And I, with the support of my colleagues in the subcommittee, really would like you to be thinking about, when it comes to the asteroid redirect mission, focusing on develop-

ment of the rocket propulsion system that will take us to Alpha Centauri. To go explore those exo-planets that are most like Earth, which appear to be far more common than we ever realized.

I deeply appreciate it. Thank you for your indulgence and the extra time, and I look forward to following up with you individually and personally, as you can imagine. It will be in great detail and very specific. I am looking forward to coming to see you, sir, and thank you for your leadership and your service to the country, and the hearing is adjourned. Thank you.

The Honorable John A. Culberson
 Subcommittee on Commerce, Justice, Science, and Related Agencies
 Questions for the Record
 NASA FY 2016 Budget Request

Europa

QUESTION 1:

Please provide a spend plan for the \$100 million provided in fiscal year 2015 for Europa and describe how fiscal year 2015 activities will be continued with the \$30 million fiscal year 2016 request for Europa. Please describe how the \$70 million reduction will impact the program during fiscal year 2016. NASA proposes a fly-by mission as opposed to an orbiter mission for Europa. Please describe the analysis that determined this path.

ANSWER 1:

Given the significant expected carry over (over \$60 million) of funds from FY 2015 to FY 2016 and the \$30 million requested in the President's FY16 request, NASA does not expect any significant impacts to the program in FY 2016.

The Europa project will transition from Pre-Phase A study activities to Phase A formulation activities in June 2015. With the FY 2014 funds that are still being expended, there is sufficient budget between FY 2015 and FY 2016 to conduct the planned Phase A activities to fully develop the requirements to support the System Requirements Review and conduct Key Decision Point B in 2016. Current estimated spending is shown below; however, this may be updated after the final instrument selection in May 2015.

Preliminary spending plan (\$M)

	<u>FY 2015</u>	<u>FY 2016</u>
Project Mgmt, Systems Engineering & Safety and Mission Assurance	23	16
Spacecraft Development	22	12
Avionics Testbed	17	8
Science & Science Payload	15	16
Mission Design	11	10
Reserves	11	8
Flight Components Qualification	7	3
Use of prior year carry-in funds	(68)	(61)
Carry out to the next year	<u>61</u>	<u>18</u>
Total	100	30

Multiple Flyby mission vs. Europa Orbiter Mission

The multiple flyby mission has been designed to achieve more than 80 percent of the science envisioned in the previously-studied Europa Orbiter concept at less than 50 percent of the estimated costs. The multiple flyby design builds on technologies and techniques developed for Cassini and Juno. For example, the very large propellant mass that would be needed for a Europa orbit insertion maneuver is instead used for focused instrumentation and shielding. A spacecraft in Europa orbit would continually be immersed in very high radiation, limiting the mission lifetime to a primary mission of just a few months and reducing overall mission data return; an multiple flyby mission does not require custom designed ultra-high radiation parts, resulting in substantially reduced mission costs. The multiple flyby mission dips into the highest radiation environment for a short duration close flyby (≈ 6 hours) to collect science data, and then gets out of the intense radiation environment to downlink the data and recharge the batteries. The mission achieves near global coverage through approximately 45 flybys without sustained, life-limiting radiation exposure.

Decadal Science Priorities

QUESTION 2:

Please identify any missions that NASA is pursuing that are not included in a recent decadal.

ANSWER 2:

All NASA science missions are either addressed in the National Research Council (NRC) Decadal Survey (DS) or mandated by law, or both. As the name DS implies, NASA and its partners ask the NRC once each decade to look out 10 or more years into the future and prioritize research areas, observations, and notional missions to make those observations.

Many NASA medium and large science missions are identified by name in each DS, for example:

- **Planetary science** - Mars 2020 Rover, Dawn (under the Discovery program), New Horizons (under the New Frontiers program),
- **Astrophysics** - James Webb Space Telescope (JWST), Wide-Field Infrared Survey Telescope (WFIRST),
- **Heliophysics** - Magnetospheric MultiScale (MMS), Solar Probe Plus (SPP), and
- **Earth Science** - Soil Moisture Active Passive (SMAP), Ice, Cloud, and land Elevation Satellite-2 (ICESat-2).

In addition, the DSs contain general statements of support for PI-led missions and small, competitively selected endeavors (i.e. Earth Venture program, heliophysics and astrophysics Small Mission Explorer (SMEX) program). Some missions and instruments are entirely consistent with explicit DS recommendations but have different names than were used in the reports, and some include necessary engineering, scientific, and budget-driven modifications.

For example, three missions are highlighted below that address explicit Earth science DS scientific and applications objectives, but were not named specifically in the 2007 DS (quoted material is directly from the DS):

- **Stratospheric Aerosol and Gas Experiment III (SAGE-III)** (developed by NASA Langley Research Center for flight in 2016 on the International Space Station (ISS), in partnership with the NASA Human Exploration and Operations Mission Directorate (HEOMD) and the European Space Agency). The 2007 DS found that “the committee has identified several [measurements] that are providing critical information now and that need to be sustained into the next decade. . . *limb sounding of ozone profiles; and temperature and water vapor soundings from geostationary and polar orbits.*”
- **Orbiting Carbon Observatory-3 (OCO-3)** (developed by the Jet Propulsion Laboratory (JPL) for flight in 2018 on the ISS, in partnership with the NASA HEOMD). Making precise measurements of atmospheric carbon dioxide levels, OCO-3 serves as the continuity bridge between the OCO-2 mission (which was under development [as OCO] as a legacy mission at the time of the DS’s release) and the DS named Tier-2 ASCENDS mission to measure “*all-season CO2 column integrals for climate emissions.*”
- **GRACE-FO** (developed by JPL for flight in 2017, in partnership with German science and space agencies). JPL and its partners are developing GRACE-FO as a bridge mission between the aging on-orbit GRACE mission (launched in 2002) and the 2007 Decadal-recommended GRACE-2 mission. GRACE-FO enables continuity of precise gravity measurements used for important operational products such as the weekly U.S. Drought Monitor.

The close alignment between the strategies, goals, and priorities in all of the DSs and NASA missions has resulted from close coordination between the NRC and NASA. This will continue as NRC undertakes its Mid-Decade Review for astrophysics this year. NASA also is initiating large mission concept studies in astrophysics for the 2020 Astrophysics Decadal Survey.

Earth Science Missions

QUESTION 3:

The Earth Science request is \$1.95 billion – a \$175 million increase above the current fiscal year. The Planetary Science budget is \$1.36 billion -- a \$77 million reduction. Other agencies such as NOAA, the National Science Foundation, the Department of the Interior, and the EPA, for example, examine changes on Earth. Given the work of these other agencies, please explain why the NASA budget is increasing in this area rather than in planetary science, which is NASA’s mission alone.

ANSWER 3:

The budget request for Earth Science demonstrates the important role that NASA Earth Science plays in the Nation’s science priorities (including those recognized in the NRC Decadal Survey) and the Administration’s confidence in NASA’s ability to effectively implement missions.

The Space Act [P.L. 85-568, 72 Stat., 426] that created NASA states the first objective for NASA is to contribute to “The expansion of human knowledge of the Earth and of phenomena in the atmosphere and space.” Thus Earth Science is part of NASA’s “core mission.” In the Congressionally-approved NASA response (Op Plan #1) to the FY 2009 appropriation, funding for Earth Science constituted 9.1 percent of the total Agency budget. In the President’s FY 2016 budget request, funding for Earth Science similarly constitutes 10.5 percent of the total Agency request.

NASA is the only civil Federal organization that can procure, develop, and launch Earth monitoring spacecraft that provide critical space-based observations to support research, and then conduct the scientific research they bring forward. NASA is responsible for providing sustained and experimental observations, and focus on space-based platforms to advance research, technology development, and national capabilities. Information and knowledge resulting from NASA’s Earth science satellite, research, and applications programs are made routinely and widely available to scientists, managers, and citizens throughout the Nation and the world. NASA’s Earth research covers diverse topics, both long- and short-term phenomena and processes, including those associated with droughts, floods, fires, air pollution, land cover/land use change, oceans, and polar ice.

The budget request for Planetary Science includes, for the first time, the formulation and development of a mission to Europa. It includes plans to release a New Frontiers Announcement of Opportunity in late FY 2016, earlier than anticipated in last year’s request. It continues support for the Mars 2020 rover that is currently in formulation, which will include a sample cache that a potential future mission could return to Earth. It grows the Planetary Science budget to over \$1.5 billion by FY 2019. These increases address high-priority goals from the National Academies’ 2012 Decadal Survey for Planetary Science.

Orion/SLS Budget Reduction

QUESTION 4:

The fiscal year 2016 budget for Exploration Systems Development, Orion, Space Launch System and Exploration Ground Systems, is \$2.863 billion, which is \$382 million reduction. NASA has said that increasing the fiscal year 2016 budget for SLS cannot result in advanced schedule or reduced Life Cycle Costs for the program. Please explain. What is the current estimate for the first un-crewed and crewed launches, by month and year?

ANSWER 4:

In 2014, NASA identified its Agency Baseline Commitment for the Space Launch System (SLS) and Exploration Ground Systems (EGS) which supports a launch capability readiness date of November 2018 at 70 percent and 80 percent Joint Confidence Level (JCL), respectively, to the Exploration Mission-1 (EM-1) launch readiness date. NASA will establish an Orion launch capability readiness date as a product of its Key Decision Point-C review in the third quarter of FY 2015, though the formal baseline for Orion will be for development through Exploration Mission-2 (EM-2).

NASA will establish an integrated Exploration Mission-1 (EM-1) launch date at the end of CY 2015 after all element Critical Design Reviews (CDRs) are complete (i.e., for Orion, the Space Launch System [SLS], and Exploration Ground Systems). The integrated launch date for EM-2 would be set following the EM-1 mission.

Increasing the FY 2016 budget for SLS would not help accelerate the schedule; if NASA were to receive additional funds, they would reduce schedule risk.

QUESTION 5:

The 2014 Orion test flight revealed issues with the heat shield design and the parachutes. What is the status of addressing these matters?

ANSWER 5:

NASA is implementing changes to address both the parachute and heatshield issues that were identified as part of the Orion development tests, not during the EFT-1 flight test.

NASA has been able to address the parachute pendulum concern using a combination of observer (Guidance Navigation & Control) and successful improvement to flight models to meet requirements. Orion is on track to move forward to CDR with this solution.

NASA has decided to pursue a block-based manufacturing approach for the Avcoat on the heatshield to satisfy flight requirements. This approach is expected to provide increased strength and improved design for manufacturability for the heatshield.

QUESTION 6:

NASA has also delayed the second round of testing on the launch abort system. Does this delay provide NASA with enough time to make all the necessary safety adjustments prior to the planned first crewed launch?

ANSWER 6:

Yes. Slated for FY 2019, the Ascent Abort-2 (AA-2) test – part of the Orion Program – involves testing the abort and attitude control motors of the spacecraft. In the event of an emergency during launch or climb to orbit, Orion's Launch Abort System (LAS) would activate within milliseconds to propel the crew module away from the launch vehicle to safety. The date for the AA-2 flight test provides sufficient time to validate the LAS ahead of the first crewed flight, EM-2. AA-2 flight test objectives build on the successful demonstration of the LAS system during the Pad Abort-1 (PA-1) test in May 2010 and will validate the refined Orion LAS design in the specific test conditions that will be achieved. The AA-2 test is part of the flight test plan supporting the first crewed SLS/Orion mission, EM-2, in FY 2021-2022. Since the AA-2 test supports EM-2 rather than EM-1, the scheduling of this test for FY 2019 does not impact the integrated launch date for EM-1, and the test will be conducted in time to inform EM-2.

James Webb Space Telescope

QUESTION 7:

The FY 2016 budget request for the James Webb Space Telescope is \$620 million, which reflects a planned reduction of \$25.4 million. The GAO noted challenges in its cryocooler development and with the project's integrated master schedule. Please provide a general progress update. Does NASA still anticipate a 2018 launch?

ANSWER:

The FY 2016 budget request needed to fund the James Webb Space Telescope is the same amount defined in the profile that came out of the 2011 rebaseline activity. In nearly 4 years, funded schedule reserve has been reduced from the replan total by only 4 months; so that as of today, Webb has 9 months of funded schedule reserve, above the 2011 projected cost and schedule reserves for this stage of the project. This cost and schedule performance is reported to GAO on a monthly basis, and is briefed for Committee staff every quarter.

There are several technical areas that currently have the greatest attention from program and project management. One of the Webb science instruments is sensitive to longer infrared wavelengths than the other three and therefore requires a special refrigeration unit, or cryocooler, to cool its detectors. The design and development of this cryocooler has proven to be quite challenging. Today, two thirds of the cryocooler hardware has been delivered; the remaining third of the hardware is undergoing final assembly and testing with a planned delivery in 2 months.

This year is an important year for James Webb Space Telescope development. Later this year, the 18 mirror segments that comprise the 21.5-foot diameter mirror will be installed on the composite backplane structure, which is undergoing its final assembly. Webb will soon enter the integration and test phase when major components are brought together for the first time and subjected to the simulated environments of launch and space. The program is within budget with adequate reserves and is currently carrying more than the planned amount of schedule reserve. This is a good position to be in as the project approaches its major integration activities. The rigorous cost, schedule and risk controls that have been employed over these four years lend confidence that the James Webb Space Telescope will launch in 2018.

Commercial Crew Program

QUESTION 8:

The NASA IG has reported that since the retirement of the Shuttle Program in 2011, NASA will pay Russia about \$1.7 billion to fly NASA astronauts to and from the International Space Station. The purpose of the Commercial Crew Program is to reestablish U.S. ability to reach the International Space Station as quickly as possible. The current fiscal year budget for this effort is \$805 million. The fiscal year 2016 request is \$1.24 billion, an increase of \$439 million, or 55 percent. Why is it necessary to have two commercial contractors? Does the support of two

commercial contractors indicate that NASA is anticipating that one of the commercial contractors will fail? Why is NASA procuring ISS crew and rescue services from Russia for use in 2018 and 2019?

ANSWER 8:

Having more than one domestic capability will provide the advantages of keeping costs low through competition, and ensuring that if one vendor's vehicle is grounded due to an anomaly, NASA would still retain a domestic option for the transport of its astronauts to the ISS. It does not indicate that NASA is anticipating that one of the commercial contractors will fail.

While NASA is confident in the ability of the companies to perform, their designs are still not fully mature. Maintaining the benefits of competition during the rest of the development lifecycle and into initial services is critical to assuring safety by enabling redundant capabilities that will provide assured access to and from the ISS. Acquiring safety critical crew transportation will be challenging and, as the Aerospace Safety Advisory Panel (ASAP) noted in its 2013 annual report, "...in a fixed-price environment, NASA should maintain competition in the CCP until there is confidence that the acceptable level of safety will be achieved." Safety of the commercial crew systems will take multiple flights to be established. Having two providers provides additional time to understand risks prior to committing to flight.

The Government Accountability Office and NASA Inspector General also have offered support for competition. For example, according to the Office of Inspector General: "Moving forward with a single company increases the risk that NASA could be left without a viable commercial option to transport crew to the ISS should issues arise that either significantly delay or render inoperable the selected company's systems." It is not in the best interests of NASA to put the Agency into a sole-source situation or to establish a monopoly on crew transportation.

NASA does not plan to purchase Soyuz seats after U.S. commercial crew services become available. On February 6, 2015, NASA issued a pre-solicitation announcement that NASA intends to contract with Roscosmos on a sole source basis for six (6) Soyuz seats and associated services for calendar year 2018 with rescue/return services extending through spring 2019. NASA needs to secure crew transportation with a known reliable provider to ensure a continued U.S. presence aboard the ISS until the sustained availability of a U.S. commercial vehicle. The intent of this proposed action is to provide the Government the ability to procure these uninterrupted services until a U.S. provider demonstrates full operational capability.

Aerospace Safety Advisory Panel

QUESTION 9:

With respect to the commercial crew programs that are in development, can you please explain the process used by the Aerospace Safety Advisory Panel (ASAP) to certify their safety? When will ASAP have access to contractor data? Please explain the process in the event that ASAP does not certify either of the commercial crew contractors?

ANSWER 9:

The Aerospace Safety Advisory Panel (ASAP) does not certify the safety of the Commercial Crew vehicles in development; NASA conducts these activities. Certification of a spaceflight system to transport NASA personnel to/from the ISS consists of four separate functions: (1) validation of the technical and performance requirements/standards; (2) verification of compliance with those requirements/standards; (3) consideration of relevant operational experience; and, 4) acceptance of residual technical risk due to hazards, waivers, non-compliances, etc.

NASA will collectively evaluate crew transportation system design changes, manufacturing (or refurbishment) process changes, and testing changes to verify the mission falls within the bounds of the system certification and that anomalies from previous missions have been addressed. NASA will decide, based on the flight readiness certification and residual risk posture, whether to authorize NASA crew to fly on the crew transportation system. During the operations/services phase, NASA will monitor the safety performance by evaluating the risk based on the significance of observed anomalies, and by updating its independent assessments of safety performance to ensure safety requirements continue to be met and there is an established process for continuous improvement towards achievement of the safety goal.

The NASA Program Manager will develop a Certification Package as described in the CCP requirements documentation. The form of the Certification Package is a compilation of pertinent plans and documents, plus presentation material, to help guide reviewers through the package. The package collectively illustrates, with supporting evidence, that the system has met the technical requirements and is safe to carry NASA crewmembers. The NASA Administrator signs off on the final Human Rating Certification Package prior to flying NASA crewmembers.

Sale or Rental of NASA Facilities

QUESTION 10:

During all other eras of human spaceflight, two launch pads have been reserved strictly for NASA human exploration programs. A change in this operating procedure has occurred over the last year, with NASA's lease of Launch Complex 39A to SpaceX for commercial operations, and the listing of the only other available Launchpad – 39B, which is intended for Space Launch System use – as partially commercial as well.

- a. Would you please explain how these relationships benefit NASA?

ANSWER 10a:

The use of only one launch pad, specifically Launch Complex 39B, is required for the Space Launch System (SLS) Program. This had left Launch Complex 39A with no mission and it would have been mothballed. This would have left a major government asset to deteriorate. Based on the NASA Authorization Act of 2010 and Commercial Space Launch Act, NASA supports the emerging commercial space industry by making unneeded assets available to

industry partners. The reuse of Launch Complex 39A by a commercial launch provider provides several benefits:

1. It allows NASA to maintain this important and costly asset in an operational mode without spending government funds.
2. It supports the mandate to support and encourage the commercial space industry.
3. Because the lessee, SpaceX plans to launch its Commercial Crew vehicles at this site, the agreement maintains two sites that support the Human Spaceflight programs of NASA.

QUESTION 10b:

What type of commercial use would occur on pad 39B?

ANSWER 10b:

Launch Complex 39-B is being constructed as a Multi-User Launch Pad. Its primary purpose is to support the SLS program launches. However, there is expected to be excess capacity available for other users. These could be commercial or other government launch providers. Appropriate users have not yet been identified, but will be evaluated on a case-by-case basis as they express interest. The types of commercial users would be launch providers using their commercial launch vehicles.

QUESTION 10c:

Do you anticipate that NASA will have adequate launch facilities available for the Space Launch System at the Kennedy Space Center in the coming years?

ANSWER 10c:

Yes, we expect that we will have adequate launch facilities to support the SLS Program.

ISS Research Management

QUESTION 11:

What can we do to optimize the relationship between NASA and the Center for the Advancement of Science in Space, or CASIS? Why aren't more private research institutions or private sector companies taking advantage of conducting research on the Station?

ANSWER 11:

NASA and the Center for the Advancement of Science In Space have an effective relationship, and outside interest in using ISS is increasing: proposal numbers in response to CASIS RFPs continue to grow, and resource requests for external activities are also growing. Currently 60 percent of CASIS-sponsored research and development projects are from a wide range of commercial companies. Repeat customers include Eli Lilly, Merck, P&G and others. Other 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. NASA is providing technical support to CASIS as they develop relationships with multiple U.S. industries, and is actively working with CASIS to nurture relationships with other Government agencies. For information on efforts to identify other Government agencies' interest in utilizing ISS, please see the National Science and Technology Council's report, "Fast-Track Action Committee on the Utilization of the International Space Station (ISS) as a National Laboratory," at the link below.

https://www.whitehouse.gov/sites/default/files/microsites/ostp/NSTC/final_iss_report_2013.pdf

Mission Trade-Offs

QUESTION 12:

In deciding to extend International Space Station operations to 2024, NASA committed itself to expend a great deal of resources that could have been dedicated to future exploration missions.

- a. Has NASA evaluated lost opportunities because of this investment?
- b. Has NASA evaluated the Return on Investment for extending the commitment to the Station for another decade?

ANSWER 12a:

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 12b:

Has NASA evaluated the Return on Investment for extending the commitment to the Station for another decade?

ANSWER 12b:

The ISS is an unparalleled asset for the conduct of research and technology development in a unique, microgravity environment. The full focus of ISS is on operations and research to: (1) improve our ability to live and work in space, including enabling human exploration beyond LEO; (2) enable development of a demand-driven commercial transportation and research market in LEO; (3) enable science, engineering research, and technology development in the fields of Earth, space, life (biological and human research), and physical sciences; and, (4) derive tangible benefits for citizens on Earth.

NASA's Human Research Program continues to develop biomedical science, technologies, countermeasures, diagnostics, and design tools to keep crews safe and productive on long-duration space missions. The progress in science and technology driven by this research could have broad impacts on Earth as it advances our ability to support long-duration human exploration.

On board the ISS, we are conducting technology demonstrations and development efforts to advance human and robotic exploration beyond LEO and the Station also serves as the foundation for an international exploration partnership. The ISS partnership is strong, and the agencies involved continue to work together in the mutual pursuit of peaceful space exploration.

A robust transportation architecture is critical to ensuring full utilization of this research facility - including research efforts that will support the development of long-duration exploration missions beyond LEO. Private enterprise and affordable commercial operations in LEO, including the transportation of crew to and from ISS (as well as rescue from ISS), will enable U.S. industry to support NASA and other Government and commercial users safely, reliably, and at a lower cost. NASA is helping to lay the groundwork for the emerging LEO space economy.

Foreign National Access

QUESTION 13:

Following a series of allegations about access of foreign nationals to information that is subject to ITAR – International Traffic in Arms Regulations – an intensive investigation was undertaken by the Inspector General, the FBI, and the Department of Homeland Security. This review occurred from 2009 through 2014. Please provide an update on improvements put in place as a result of those inquiries.

ANSWER13:

NASA takes the responsibility of securing sensitive and export-controlled information at its facilities and within its IT systems very seriously and is working to implement all of the recommendations from several external audits and reviews. Recognizing the growing threat aimed at government agencies by hostile nation-states and foreign adversaries, the NASA Administrator has already directed a number of actions to further secure sensitive and export-controlled information at NASA facilities and within its IT systems and to enhance overall

security. The Government Accountability Office (GAO) report published in April 2014 complements recent reviews conducted by the NASA Office of the Inspector General (OIG) and the National Academy of Public Administration (NAPA), which provided its findings to the NASA Administrator in January 2014. The NASA responses to the GAO, OIG, and NAPA recommendations are assisting in our continuing efforts to enhance all aspects of our foreign national access management, information technology security, access to sensitive information, and NASA's export control compliance program. The GAO report made seven recommendations to the NASA Administrator intended to ensure consistent implementation and improve oversight of NASA's export control program. NASA has accepted all seven of these recommendations and is in the process of implementing those recommendations.

Since the completion of these reviews, NASA established the Foreign National Access Management Program on March 10, 2014. This program focuses on: (1) providing consistent guidance, training, and oversight across all NASA Centers; (2) engaging all stakeholders in the identification of best practices and creation of operational manuals and materials; and, (3) incorporating stronger compliance and accountability mechanisms into NASA's existing Center Integrated Security Functional Reviews.

NASA has also developed an Export Control Program Operations Manual that provides the implementing guidelines for NASA's Export Control Program. It provides processes and best practices for properly and consistently fulfilling our export control obligations. To complement the Operations Manual, NASA is developing position-specific training targeted at those individuals that are involved with handling export controlled hardware and technology or that interact with foreign nationals. Awareness training that is more broadly geared to all NASA employees is also under development.

Additional Questions:

QUESTION 14:

Many of NASA's greatest accomplishments in recent years have occurred when mission planning is driven by the science priorities as laid out in the Decadal surveys – particularly in the areas of planetary science. However, despite consistent, yearly support from Congress the White House has proposed a lower budget for the planetary account that is insufficient to meet the objectives of the Decadal Survey. How does NASA intend to ensure that top mission priorities are accomplished?

ANSWER 14:

The FY 2016 President's budget request includes a total budget for Planetary Science of \$1,361.2 million for FY 2016. This request is part of a broader approach to maintain balance across NASA within a constrained fiscal environment, and to ensure that the President's FY 2016 budget request is consistent with available resources while still maintaining the highest priority science across the portfolio of Planetary Science programs.

To ensure top mission priorities are accomplished, this budget provides the full five-year funding plan for the Mars 2020 mission, initiates formulation for a new mission to Europa, as well as releases the next New Frontiers Announcement of Opportunity in 2016. Additionally, the FY 2016 request continues development of InSight (Interior Exploration Using Seismic Investigations, Geodesy and Heat Transport) and OSIRIS-REx (Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer); supports the production of planetary exploration enabling Plutonium-238 in partnership with the Department of Energy; provides for instrument contributions to ESA's BepiColombo, ExoMars and JUICE (JUpiter ICy moons Explorer) missions; and maintains support for planetary science technology and research awards.

QUESTION 15:

NASA recently announced the next Mars communication orbiter scheduled for launch in 2022. The Mars exploration program is a critical asset to America. I am pleased that NASA recognizes the importance of ongoing exploration of our planetary neighbor and hopes to eventually return a Mars sample to Earth. How is NASA leveraging the successful Curiosity mission to enable economies of scale in future missions such as Mars 2020?

ANSWER 15:

While no specific plans beyond 2020 have been established, NASA does recognize the importance of ongoing exploration of the Red Planet. This is evidenced by the fact that the Mars 2020 mission is being designed to satisfy the top-rated priority large mission recommendation of the current Planetary Science Decadal Survey [Vision and Voyages, NRC 2013-2022]. To save costs, the Mars 2020 mission will use the architecture of the Curiosity mission as it is a proven delivery system to put a highly capable rover on Mars, and take advantage of hardware remaining from the Curiosity mission as well as existing vendors ready to replicate proven hardware. The Mars 2020 mission will be looking for signs of ancient life on Mars, a very different objective than Curiosity's, which was looking for signs of habitability. The Mars 2020 mission will host a suite of completely different instruments that have already been competitively selected, and a collaborative HEO/STMD involvement including NASA's first In-Situ Resource Utilization (ISRU) instrument. Furthermore, the mission includes the capability to cache samples of extreme interest that could be returned to Earth. As an additional consideration, through Curiosity operations, we are learning ways to improve operational efficiency, thereby increasing the amount of science accomplished in any given time, which will be applied to the Mars 2020 mission.

QUESTION 16:

The Mars opportunity rover continues to be an invaluable scientific tool in strengthening our understanding of Mars and inspiring the next generation of space explorers. I am concerned about NASA's plans to prematurely cancel this important program in spite of the rover's track record of providing high-quality scientific data long after its projected lifetime. What is NASA's justification for attempting to cancel this program? A number of Members of Congress have expressed support for continuation of this program, how does NASA plan to carry through on continuing the great work?

ANSWER 16:

Now in the eleventh year of a 90-day mission, Opportunity long ago completed all of its original science requirements. At this time, the Mars Exploration Rover Opportunity is fully funded through FY 2015 and continues to return high-quality scientific data about the Red Planet. Opportunity was not funded in the FY 2016 budget request given higher priorities; however, NASA's Planetary Science Division will reassess the condition and cost of maintaining Opportunity this summer.

QUESTION 17:

A steady cadence of well-planned missions is necessary to ensuring that NASA can meet the objectives of the Decadal Survey and continue enriching our lives with discoveries about our universe. Please describe how NASA intends to execute a consistent cadence of missions, including a mission to Europa in order to meet the necessary scientific objectives in the coming decades. Can NASA share with the Committee a list of missions through the 2020's that meets these objectives?

ANSWER 17:

Scientific priorities for future science missions are guided by the National Academies' decadal surveys, which seek to outline the priorities of the scientific community. The first Earth science decadal survey was published in early 2007. New decadal surveys in astrophysics, planetary science, and heliophysics were released in 2010–2012, as was the midterm assessment of the Earth science decadal survey. NASA uses these surveys as the principal source of science community input into its science planning processes. Astrophysics is guided by the 2010 *New Worlds, New Horizons in Astronomy and Astrophysics*. Planetary science is guided by the 2011 *Vision and Voyages for Planetary Science in the Decade 2013–2022*. Heliophysics is guided by the 2012 *Solar and Space Physics: A Science for a Technological Society*. Finally, Earth science is guided by the 2007 *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond*.

NASA issues a strategic plan every four years. To complement the NASA strategic plan, NASA SMD produces a science plan at the same cadence. NASA last produced its science plan in 2014, which focused on changes to the program planned for 2014–2018. The next edition of the science plan is scheduled for early 2018, and will be informed by a new Earth science decadal survey and potentially the midterm assessments of the astrophysics, planetary science, and heliophysics decadal surveys.

In selecting new missions, NASA strives for a diverse portfolio that provides adequate mission cadence to meet the need for connected measurements, as well as using different mission types and sizes and capabilities, from small and focused, to large and complex. This approach helps avoid any critical gaps in mission planning.

QUESTION 18:

NASA's Space Technology program develops critical capabilities that are needed for future space exploration activities, including recent advancements in entry, descent, and landing approaches that may enable the delivery of heavier payloads to destinations beyond low Earth orbit. Can you provide additional insight into how this and other Space Technology program developments are instrumental in unlocking potential concepts for both future science and human exploration missions?

ANSWER 18:

Through rapid development, demonstration and infusion of transformative technologies, the Space Technology Mission Directorate advances the Nation's capabilities in space and enables the Agency's future missions. Sustained investments in Space Technology provide us with better tools to understand our universe, new capabilities that will extend human presence beyond low earth orbit, and crosscutting solutions that advance the commercial space enterprise.

To enable scientific discovery, the directorate will complete software development of Station Explorer X-ray Timing and Navigation Technology (SEXTANT) at the Goddard Space Flight Center, which will evaluate real-time X-Ray data from known regular pulsars to demonstrate deep space navigation. This ISS demonstration will use pulsars for navigation similar to the way we use GPS on the Earth today. Also in partnership with the Science Mission Directorate, Space Technology is advancing coronagraph technologies for the Wide Field InfraRed Survey Telescope/Astrophysics Focused Telescope Assets (WFIRST/AFTA) mission. This technology will dramatically improve our ability to directly observe exo-planets, and interrogate the atmospheric properties of these distant worlds allowing humanity to discover for the first time whether some of these exo-planets are habitable and potentially even detect the hallmarks of life.

In 2016, Space Technology will conduct an in-space demonstration of its new Deep Space Atomic Clock. This new atomic clock greatly enhances navigation accuracy, frees up scarce communications bandwidth for science data, and improves gravitational measurements, necessary for future planetary science and exploration missions. As one example, this technology could enable future missions to detect under-ice, liquid water oceans. Additionally, the new atomic clock will provide next-generation GPS satellites with dramatically improved navigational accuracy and time-keeping stability. The Deep Space Atomic Clock technology was incentivized in the Science Discovery 2014 solicitation, which will enable infusion once the technology development phase is complete.

Additional key technology developments currently supported by Space Technology and considered essential for future science missions to the icy moons of the outer planets include:

- Deep Space Optical Communications to provide high bandwidth science data return at reduced power levels;
- Advanced radiation tolerant spaceflight computing for avionics and onboard processing in the high radiation environments of the outer planetary systems;

- Advanced autonomous mobility systems to allow for exploration of the surfaces of icy moons; and
- Woven Thermal Protection System materials, a key EDL (entry descent and landing) technology needed not only to perform aero-capture at the outer planets but also to put future human class payloads to the surface of Mars.

Space Technology is also developing technological solutions that will improve performance, reliability and affordability for SLS and Orion. An example of an early success is seen in the Composite Cryogenic Propellant Tank. In collaboration with Boeing, NASA completed fabrication and ground demonstration of the world's largest composite cryogenic propellant tank, verifying the ability to develop large-scale cryogenic propellant tanks that are 30 percent lighter and provide for a 25 percent reduction in production costs relative to state of the art metallic tanks. NASA, as well as the aerospace industry are currently exploring opportunities to infuse this technology into the Space Launch System, commercial launch vehicles, and other aerospace applications that could benefit from utilizing large-scale composite structures.

Space Technology is also investing in a series of other technologies that will enhance and enable our science and exploration capabilities to Mars. Under EDL technologies for Mars, Space Technology is investing in Low Density Supersonic Decelerators, both inflatable and mechanically deployable hypersonic entry systems, and EDL instrumentation on Mars 2020. These EDL technology investments are all focused on increasing our payload landing capacity at Mars, eventually allowing for human missions to the surface of the red planet.

Working with small business partner Bally Ribbon Mills, Space Technology developed one variant of the woven TPS material mentioned above to solve a critical challenge on the Orion spacecraft. The new materials are now baselined to serve as Orion's compression pads, a critical component that must carry launch loads during ascent, and also doubles as an integral part of Orion's heat shield. Space Technology is also developing two phase-change material heat exchangers, one using wax and one using water, and with both planned for demonstration on ISS in 2016. Orion will use one of these two heat exchangers to perform challenging exploration missions such as ones in lunar orbit where adequate heat rejection poses a greater challenge.

The Space Technology Mission Directorate also supports technology maturation for the long-range capabilities required for humans to explore deeper into the solar system. Recent efforts led to fabrication and delivery of a new variable oxygen regulator and carbon dioxide removal system for next generation portable life support systems to the Human Exploration and Operations Mission Directorate. These components will be validated as a part of an integrated systems test in FY 2015, and demonstrated on the International Space Station in FY 2016. In addition, Space Technology initiated development of an oxygen production instrument for demonstration on the Mars 2020 mission that aims to convert carbon dioxide from the Mars surface to oxygen with 99.6 percent purity. This precursor effort, conducted in collaboration with Exploration and Science, will verify that in situ resource utilization technologies can produce enough oxygen at Mars to supply both human breathing needs as well as propellant oxidizer for Mars ascent rockets used to send people, science and equipment back into space for their trip back to earth. These life support and in situ resource utilization technologies are

necessary building blocks for human missions beyond low Earth orbit where power and consumables such as oxygen and water are not readily available.

A critical component of the Space Technology portfolio is crosscutting technologies that have broad aerospace industry applications. In addition to the composite cryogenic propellant tank noted above, the directorate worked with ATK and Deployable Space Systems to conduct thermal vacuum and performance tests for two competing approaches for large-scale, high-power, deployable solar array systems. This technology development effort enabled manufacturing advances, weight savings, and packing efficiencies that dramatically improve the affordability of commercial satellites. The Directorate matured solar array technology in order to support a high-powered solar electric propulsion demonstration. On completion, this system will enable more efficient orbit transfer for satellites and accommodate increasing power demands for government and commercial satellites.

In addition to solar arrays, Space Technology will validate a new green propellant formula as well as compatible thrusters, and integrated propulsion system. In 2016, the directorate will conduct the first flight demonstration of the AF-M315E propellant in the Green Propellant Infusion Mission with partners Aerojet and Ball Aerospace. On successful demonstration, the propellant and propulsion system will provide industry with a safe and better-performing alternative to highly toxic hydrazine.

In another example of a crosscutting capability, STMD will fly the Laser Communications Relay Demonstration mission in 2019. The mission will be hosted on a commercial communications satellite in Geo-synchronous orbit and demonstrate the ability to perform high bandwidth symmetric bi-directional communications. The capability has strong interest from the satellite communications industry and form the backbone for next generation TDRSS.

Space Technology is also taking an active role in fostering emerging industries. For example, Space Technology completed the assembly of Edison Demonstration of Smallsat Networks (ESDN) spacecraft, which will perform an orbital demonstration of a cluster of eight CubeSats to perform cross-linked network communications and distributed science measurements. Space Technology is also completing flight hardware for a variety of small scale, in-space technology demonstrations including laser communications and navigation using CubeSats, and a suborbital demonstration of a small Earth return capsule. Improvements gained from these technology efforts will be shared widely across the aerospace industry to ensure infusion into future spacecraft designs. Further examples of technologies with crosscutting application to both NASA and industry needs include high performance spaceflight computing, robotics for extreme environments and advanced manufacturing capabilities with government and industry partners.

From Space Technology's investments in Early Stage Innovation, to ground demonstrations in test chambers and in the lab and through technology demonstrations in space, the Agency is exploring, testing and proving innovations that will serve the aerospace enterprise for decades to come.

**The Honorable Robert B. Aderholt
Subcommittee on Commerce, Justice, Science, and Related Agencies
Questions for the Record
Hearing on the NASA FY 2016 Budget Request**

Human Exploration

QUESTION 1:

What progress has NASA made towards finalizing a design for the EUS (enhanced upper stage) for SLS, finalizing a contract, and building this?

ANSWER 1:

NASA has undertaken a number of activities which have advanced the development and reduced the risks of the Exploration Upper Stage (EUS). In November 2014, NASA received responses to a request for information (RFI) on potential options for an EUS engine. In January 2015, NASA completed a systems requirements and design review for EUS, covering the requirements and initial design concepts for EUS, as well as integration of the stage into the rest of SLS and with the ground systems. For EUS, NASA has purposefully developed a set of common design elements and manufacturing approaches which are applicable to both core stage and EUS with a common diameter, including avionics, structures, thermal protection, welding and other manufacturing approaches. The SLS core stage forward skirt, including shelf mounts, interfaces, isolation, and common vehicle avionics are designed to be migrated to EUS without significant modification. Along with common materials and weld geometries and schedules, the common diameter and materials used in the core stage and EUS allows the reuse of all the major core stage weld tools at the Michoud Assembly Facility including the Vertical Weld Center (VWC), the Segmented Ring Tool (SRT), and the Vertical Assembly Center (VAC).

QUESTION 1a:

How many ICPS units does NASA currently plan to obtain?

ANSWER 1a:

Boeing is on contract for one Interim Cryogenic Propulsion Stage (ICPS), including relevant test and integration activities, for EM-1. The contract has an option for production of a second ICPS. Additional cost and effort would be required to human rate ICPS for EM-2.

QUESTION 1b:

What is the price of the ICPS unit for mission EM-1?

ANSWER 1b:

The cost for procuring the ICPS for EM-1 is \$287M. This includes the work needed to integrate the stage into Space Launch System (SLS). This cost does not include human rating.

QUESTION 1c:

What would the cost be of human rating the ICPS?

ANSWER 1c:

The costs of procuring a human-rated ICPS for EM-2 have not been negotiated, but are estimated to be approximately \$350-400M.

QUESTION 1d:

What is the performance difference between the ICPS and the EUS?

ANSWER 1d:

Exploration Upper Stage (EUS) is one element of an integrated Block 1B SLS configuration that would also include upper stage engines, a new stage adaptor, as well as associated changes to ground system elements. Block 1B would eventually provide increased capability over Block 1 by enabling single-launch support for a greater variety of missions and destinations necessary to demonstrate deep-space exploration capabilities in the proving ground of cis-lunar space (including in lunar orbit and the Earth-Moon Lagrange points).

QUESTION 1e:

What amount is budgeted specifically for the EUS in FY 2016, FY 2017, FY 2018 and FY 2019?

ANSWER 1e:

The FY 2016 President's budget request assumes the same Block 1 SLS configuration with an ICPS for EM-2 as for the first flight on EM-1. EUS is one element of an integrated Block 1B SLS configuration that would also include upper stage engines, a new stage adaptor, as well as associated changes to ground system elements. The FY 2016 budget request does not include funds for Block 1B development in FY 2016 – FY 2019.

QUESTION 1f:

Please provide a multi-year budget, for SLS, to fly an EM-2 mission, with an EUS upper stage, in 2021.

ANSWER 1f:

The FY 2016 President's budget request does not include funds for Block 1B development in FY 2016 – FY 2019. The EUS is one element of an integrated Block 1B SLS configuration that would also include upper stage engines, a new stage adaptor, as well as associated changes to ground system elements. Estimates to date for development through first flight of a Block 1B SLS with EUS (including the procurement and integration of upper stage engines, a new universal stage adaptor, vehicle integration, and ground modifications) have been in the range of \$1.5-2.0 billion. However, those estimates are very preliminary, and not based on a level of design maturity where NASA would normally provide cost ranges.

QUESTION 2:

What is the total multi-year cost to the Exploration budget of the development of Commercial Crew?

ANSWER 2:

The Commercial Crew Program (CCP) has had \$2.8B appropriated for it through FY 2015. The FY 2016 President's budget requests another \$2.75B through FY 2020 which includes development funding and all NASA Program Office labor and management costs. The President's budget request for CCP also includes funding for 2 Post Certification Missions to the ISS (non-development). Full funding of Commercial Crew will allow us to reach full operational tempo and stop sending around \$500 million per year to Russia for crew transport.

QUESTION 3:

SLS is not an Orion-capable launch vehicle only. What payloads, including those from commercial partners, would be suitable for a 2018 SLS launch if the Orion is not ready in 2018?

- a. If you have none, please initiate a process, including an RFI, to secure answers to that question.

ANSWER 3a:

It is important to keep NASA's human exploration program on track for a human mission to Mars in the 2030s. This requires demonstration of an integrated Orion/SLS capability on EM-1.

QUESTION 4:

What work has been done so far to determine the cost and usefulness of an in-space trash collector, lofted on an SLS, to LEO in order to collect space station trash, thus avoiding the high cost of multiple, smaller capacity commercial flights to collect trash?

ANSWER 4:

Trash is already removed from ISS via, Cygnus, Progress, and H-II Transfer Vehicles (HTV). NASA has not conducted a study of this use of the SLS, but it should be noted that a mission to low Earth orbit (LEO) would be an inefficient use of this launch vehicle, which has been designed for deep-space missions. The SLS is a heavy lift launch vehicle and has payload capability far and above that which is necessary to support ISS; therefore, launching an SLS for ISS-related activities would be a highly inefficient use of the system that is simply not cost-effective.

QUESTION 5:

Since FY 2014, has NASA added requirements to the Orion capsule for EM-1?

ANSWER 5:

NASA maintains a requirements set for Orion crew capability, not for individual flight tests. NASA does have a set of flight test objectives for each individual flight during development of Orion, where each flight test and ground test cumulatively contributes to our confidence in putting a crew on the EM-2 flight. NASA has not added new requirements. Flight test objectives have been reallocated across different tests as part of the normal development process.

QUESTION 5a:

If so, what is the cost of those added requirements and why were they so late in being requested?

ANSWER 5a:

No requirements were added.

QUESTION 5b:

Does the FY 2015 [*sic*; FY 2016?] request for Orion match what is needed for Orion to be ready in 2018? If not, why not?

ANSWER 5b:

NASA will establish an integrated EM-1 launch date at the end of CY 2015 after all element Critical Design Reviews (CDRs) are complete (i.e., for Orion, SLS, and Exploration Ground Systems). NASA baseline still supports an EM-1 launch in 2018 with an aggressive development plan. Orion will conclude Key Decision Point-C (KDP-C) in the summer of 2015 and CDR in October 2015, which, together, will determine whether the plan and the Agency commitment were accurate.

QUESTION 5c:

What is the projected cost of the EM-1 Orion?

ANSWER 5c:

NASA's most recent formal development cost range is from KDP-B, which is a life cycle cost through EM-2 plus one quarter of \$8.5-10.3 billion starting from the beginning of FY 2012. This cost range includes Exploration Flight Test-1 (EFT-1), EM-1, Ascent Abort-2 (AA-2), EM-2, and all other development and test work. NASA does not track development costs by allocating those costs to individual development events such as ground or flight tests. For affordability purposes, many assets are used to achieve multiple development test objectives. NASA will update the development cost for Orion as part of the process begun with Preliminary Design Review and culminating in KDP-C in the mid-2015.

QUESTION 5d:

What is the projected cost of the EM-2 Orion?

ANSWER 5d:

Please see response to Question #5c, above.

QUESTION 6:

Please acknowledge that the launch services know that it is not the management agent for SLS flights, and that those flights will continue to be managed by the HEO.

ANSWER 6:

The NASA Launch Services Program (LSP) reports to the Director of Launch Services at NASA Headquarters. Both LSP and the Director of Launch Services are part of NASA's Human Exploration and Operations Mission Directorate (HEO). LSP procures and manages commercial launch services for civil sector payloads. In the case of the potential use of SLS for other than Orion flights (e.g., science flights), the SLS launch would be "managed" by the current NASA Exploration Systems program management that oversees SLS development, which also reports to HEO. LSP may be asked to support science payload mission integration activities since that is a key area of LSP expertise.

QUESTION 7:

What is the progress of BAA's and RFI's to advance the possibilities of robotic and perhaps human-transport-capable landers for operations on the Moon (and therefore later, a moon of Mars, or Mars itself)?

ANSWER 7:

Building on the progress of NASA's partnerships with the U.S. commercial space industry to develop new spacecraft and rockets capable of delivering cargo -- and soon, astronauts -- to low-Earth orbit, the Agency recognizes the U.S. industry's interest in reaching and exploring the

Moon. Commercial robotic lunar lander capabilities could address emerging demand by private customers who wish to conduct activities on the Moon and could also enable new science and exploration missions of interest to the larger scientific and academic communities. NASA's Lunar Cargo Transportation and Landing by Soft Touchdown (Lunar CATALYST) initiative has established multiple no-funds-exchanged Space Act Agreement (SAA) partnerships with U.S. private sector entities. The purpose of these SAAs is to encourage the development of robotic lunar landers that can be integrated with U.S. commercial launch capabilities to deliver payloads to the lunar surface.

QUESTION 8:

What test stand and other construction work (particularly in the FY 2016 and FY 2017 budget) is needed to ensure that the SLS could launch by late 2018?

ANSWER 8:

Test stand and other construction work in support of SLS is nearing completion in FY 2016 and FY 2017. At the Marshall Space Flight Center (MSFC) in Alabama, \$7.2 million is planned in FY 2016 to complete the SLS structural test article test stands 4693 and 4697. Approximately \$10.5 million of work is also planned in FY 2016 to maintain the functionality of the SLS production line at the Michoud Assembly Facility (MAF) in Louisiana.

Environment. CECR

QUESTION 9:

Mr. Administrator, as you know, there is a site called the Santa Susana Field Laboratory, in California, which is being cleaned up largely with taxpayer dollars. There are five different levels of soil cleanup. My understanding is that in 2011, the US District Court of the Central District of California ruled California Law SB 990 was unconstitutional and that one company involved should pay to have the site cleaned up at the RESIDENTIAL level. It also found that "it is undisputed that cleanup to the residential level will fully protect human health and environment." This ruling was upheld by the 9th Circuit Court of Appeals in 2014. NASA, however, is using its own funding to clean the site to the level called BACKGROUND, at **nearly three times the cost**. The ruling against SB 990 provides a strong basis for NASA to comply in the same manner. Is NASA's plan to continue to spend what could be \$200M or more on this site? If not, and I hope not, please explain to me what steps NASA has taken to cancel its agreement with the state of California, and the legal steps necessary to comply only with the level of cleanup which was ruled adequate by the District court decision.

ANSWER 9:

Yes, NASA must abide by the 2010 Administrative Order of Consent (AOC), with the State of California, in meeting its commitment to cleaning up the environmental contamination resulting from historical operations at the federally owned portion of Santa Susana Field Laboratory (SSFL). Two Consent Agreements govern NASA's requirements for cleanup: the first

agreement in 2007 that addresses groundwater and the second agreement in 2010 that addresses soil. The second agreement is referred to as the Administrative Order of Consent (AOC) and dictates a cleanup of soil to background levels. After consulting with the Department of Energy and NASA, the Department of Justice chose not to intervene in the SB990 litigation. NASA has not approached the California Department of Toxic Substance Control (DTSC) to modify the AOC, but is working closely with DTSC within the AOC framework to minimize the environmental damage by reducing the volume of soils to be removed from the site. NASA is currently defining the volume of soil to be cleaned up and exploring the best alternatives to effectively clean up the site while preserving the sensitive natural and cultural resources at the site. NASA is committed to work with the regulators, the local community, and all interested stakeholders to ensure transparency throughout this process.

QUESTION 9a:

Finally, if NASA has been asked by private entities to perform cleanup at the "background" level, please identify that entity and why taxpayers should subsidize this effort at a time of such fiscal restraints as currently faced by the agency.

ANSWER 9a:

As stated previously, NASA must abide by the terms of the 2010 Administrative Order of Consent. During NASA's public review of the Draft Environmental Impact Statement (DEIS) NASA received 4,164 comments. Of the comments, 2,622 were very similar in content and supported NASA's commitment to the AOC. These comments may be found at <http://foia.msfc.nasa.gov/docs/SSFL/>

NASA officials use of personal email to conduct government business

QUESTION 10:

As you recall nearly five years ago, the Senate Commerce Committee began the subpoena process to retrieve emails of NASA officials, including former Deputy Administrator Lori Garver. The inquiry was sufficed before the Committee was able to focus on the use of personal emails.

- a. In light of former Secretary of State Hillary Clinton's use of personal email to conduct government business, are you aware of any NASA political appointees using personal emails or texts to conduct official business?

ANSWER 10a:

No.

QUESTION 10b:

Are you aware of former or current officials providing official privileged information to anyone outside of NASA that could have been used as a competitive advantage?

ANSWER 10b:

No.

QUESTION 10c:

What safeguards are in place to prevent misuse of personal email for NASA business?

ANSWER 10c:

In conjunction with the Presidential and Federal Records Act Amendments of 2014, the NASA Chief Information Officer (CIO) briefed all Agency senior officials on their responsibilities as Federal government officials when using non-government email systems. As a minimum, they are required to post any government emails or electronic communications to NASA government systems within 20 days of the communication. Additionally, the latest update to the NASA Records Retention Schedule (NRRS) 1441.1A, effective April 2015, NPR 1441.1E, NASA Records Management Program Requirements, Sec 5.4, and IT Handbook 1440.01, Records Planning and Management: Records Management and Life Cycle – Overview includes the following mandate:

Records of Management:

Records created and received by NASA management not included in a specific case file.

- A. Records created and received in any and all media that substantially document the development and management of NASA policy, operations and programs. Often arranged as general subject files, they typically include briefings, reports; presentations; studies, substantive correspondence, email and informal notes...
 1. Administrator, Center Directors, their deputies and associates who help execute the functions of the Administrator and Center Directors; and heads of Agency or Center Mission Directorates or other direct mission support offices.
 - a. Retention: Permanent. Cut off at end of fiscal or calendar year.
Retire to FRC when 5 years old in 5 year blocks. Transfer to the National Archives when 10 years old.
 2. Heads of other offices (functional offices concerned with Agency or Center infrastructure and administration) such as CIO, CFO, Human Capital, Facilities Operations organizations, etc.
 - a. Retention: Temporary. Cut off at end of fiscal or calendar year.
Destroy or delete between 5 and 15 years after cutoff.

Earth Science**QUESTION 11:**

What is the total launch cost for Earth Science missions planned for FY 2016, FY 2017, and FY 2018?

- a. What is the total scientific-payload development cost for those missions?
- b. Have any other countries offered to help pay for the funding of any part of those launch and development costs?
- c. The United States has achieved more than most countries in reducing pollution. This Administration has hampered the use of proven sources of energy production, including killing coal energy at the same time that Germany is making new investments in coal energy, and killing the Canadian pipeline, as well as issuing punishing EPA constraints and guidelines that are almost impossible to measure or comply with. These actions cost billions of taxpayer dollars and cost consumers more due to these harmful actions and regulations. Apart from Earth Science related work at NOAA, the President is requesting \$1.95B for the NASA Earth Science program. That is more than 2/3 of the request for human Space Exploration. How do you explain Earth Science in that context?

ANSWER 11a,b,c:

The total launch cost, and total scientific-payload development cost, for Earth Science missions planned for FY 2016, FY 2017, and FY 2018 are detailed in the table below:

Earth Science Launches, FY 2016-FY 2018		
SM	Total Launch Cost (Formulation and Development, Phases A- D) , including Launch Vehicle (if applicable), Ground System and Science Costs	Total Science Payload Development Cost (Phases A-D) , not including Launch Vehicle, Ground System and Science Costs
SAGE-III*	118.4	109.3
CYGNSS	168.5	101.0
GRACE-FO**	371.4	357.5
ICESat-2	1012.8	807.7
TOTAL	1671.0	1375.5

*Launch to ISS provided by the ISS Program

**Launch provided by international partner (German Research Center (GFZ))

Several partners support these missions. SAGE-III is being developed by NASA (Langley Research Center, Science Mission Directorate, Human Exploration and Operations Mission Directorate) in partnership with the European Space Agency, which is supplying the essential precision pointing platform for the instrument. SAGE-III will launch in the "Dragon Trunk" of a Space-X Commercial Resupply mission to the International Space Station. GRACE-FO is being

developed by NASA (Jet Propulsion Laboratory, Science Mission Directorate) in partnership with German science and space agencies. In particular, the German Research Center (GFZ) is providing the launch contract and is funding all launch services for the GRACE-FO mission, in addition to providing funding for key elements of the satellite payload.

The budget provided for Earth Science demonstrates the important role that NASA Earth Science plays in the Nation's science priorities (including those recognized in the NRC Decadal Survey) and the Administration's confidence in NASA's ability to effectively implement missions.

The National Aeronautics and Space Act of 1958 [P.L. 85-568, 72 Stat., 426] that created NASA states the first objective for NASA is to contribute to "The expansion of human knowledge of the Earth and of phenomena in the atmosphere and space." Thus Earth Science is part of NASA's "core mission." In the Congressionally approved NASA response (Op Plan #1) to the FY 2009 appropriation, funding for the NASA Earth Science Division constituted 9.1 percent of the total Agency budget. In the President's FY 2016 budget request, funding for the NASA Earth Science Division similarly constitutes 10.5 percent of the total agency request.

NASA is the only civil Federal organization that can procure, develop, and launch Earth monitoring spacecraft that provide critical space-based observations to support research, and then conduct the scientific research they bring forward. NASA is mandated to provide sustained and experimental observations, and focus on space-based platforms to advance research, technology development, and national capabilities. Information and knowledge resulting from NASA's Earth science satellite, research, and applications programs are made routinely and widely available to scientists, managers, and citizens throughout the Nation and the world. NASA's Earth research covers diverse topics, both long- and short-term phenomena and processes, including those associated with droughts, floods, fires, air pollution, earthquakes, freshwater availability, sustained land imaging (land cover/land use change), oceans, and polar ice.

Regarding human space exploration, the FY 2016 President's budget request clearly shows our ultimate goal is to send humans to Mars. NASA is executing an integrated human and robotic exploration strategy that is supported by the FY 2016 budget request. This strategy yields a series of tangible milestones and capabilities that lead forward toward human missions to Mars. Designed in coordination with our international partners, this strategy maintains America's role as the world's leader and foundational partner in space exploration.

QUESTION 11d:

The fact that Exploration is only funded, in your request, at 1/6 the NASA \$18B budget seems to indicate that our nation's goals in space have almost been abandoned. Why is this budget not more responsive to the American people's interest in human space exploration? Visiting the Space Station, visible from the ground, is not space exploration.

ANSWER 11d:

NASA has long had a diverse research and development portfolio beyond human space exploration, including an array of robotic science missions, technology development efforts, and

programs designed to advance aeronautics. The President's FY 2016 budget request will allow NASA to continue to lead the world in space through a balanced program of technology development, exploration, and science, NASA's Exploration budget funds the development of SLS, Orion, and the ground systems required to launch crews into deep space. Further, it funds development of essential capabilities, such as environmental control and life support for human deep space exploration that we will continue to test on ISS. It leverages prior and ongoing technology investments in the Space Technology Mission Directorate (STMD) in solar electric propulsion and other technologies and work by industry on other advanced propulsion systems, habitation systems, and life support technologies for future missions. In Space Operations, our work on the ISS is essential to prepare for long-term missions in deep space. For example, on March 27, 2015, astronaut Scott Kelly began a one-year mission aboard the ISS to learn more about how to live and work in space for the long term. We will compare his vital signs to those of his twin brother, Mark, here on Earth in a first-ever experiment using identical twins to learn more about the effects of living in space. This is just one example of the vital knowledge and technology that our outpost in space will provide over the coming decade. The Space Station is the cornerstone of our exploration strategy, a nearby outpost in space where humanity is taking its early steps on its journey into the solar system.

Earth Science, climate change

QUESTION 12:

The evidence is clear that the expensive global climate modeling effort supported in your budget has yet to reproduce the actual observations of the deep atmosphere of the last 3+ decades. This is the part of the atmosphere that is most affected by greenhouse gases so it needs to be done correctly. Are you willing to support independent research for those unaffiliated and even critical of the modeling industry to investigate these shortcomings on behalf of the American people? This is vital because tens of thousands of jobs are being lost based on model projections shown here which to anyone's eye are invalidated by real observations.

ANSWER 12:

NASA welcomes independent research conducted by investigators affiliated with outside agencies, companies, or universities. NASA's Research and Analysis program competitively solicits proposals and then peer-reviews for their intrinsic merit, relevance, and cost reasonableness. Any investigator who is not affiliated with a foreign institution is free to submit a proposal, including investigators critical of NASA's global climate modeling efforts. It is worth noting that research proposals are generally funded to solve outstanding research questions or modeling issues. Such proposals tend to look very carefully at existing modeling approaches, because otherwise they would not be able to argue that there is an issue to be addressed by their proposed research activity.

NASA also supports independent research by making its global models freely available to anyone who wishes to examine or use the models in their own research. NASA provides supercomputing resources without charge to external investigators who are funded through NASA research solicitations. In addition, NASA submits model runs to international inter-

comparison and evaluation exercises such as the World Climate Research Program Coupled Model Inter-comparison Project, which enables independent investigators to examine and evaluate NASA model results through comparisons with observations and other models.

Earth system models must not only address processes in the atmosphere, but also in the ocean, land, and ice systems, and their interactions as well. Hundreds of comparisons, with many different kinds of data, are routinely employed to evaluate such models.

Evaluation of modeled mid-tropospheric temperature trends based on observations over the last three decades is just one of many comparisons that are performed. For this specific comparison, trends naively calculated from satellite observations have inaccuracies and uncertainties resulting from drifts in the equatorial-crossing times of the numerous satellite platforms. Recent research indicates that some previous reconstructions are in error due to flaws in their treatment of this problem, and newer results based on what is considered to be a more realistic treatment of this issue yield a much better comparison between global climate models and observations [for example, Po-Chedley, Stephen, Thorsen, Tyler J., and Fu, Qiang, Removing Diurnal Cycle Contamination in Satellite-Derived Tropospheric Temperatures: Understanding Tropical Tropospheric Trend Discrepancies, *Journal of Climate* 28, 2274 - 2290, doi: 10.1175/JCLI-D-13-00767.1, 2015].

Commercial Cargo competition and sourcing

QUESTION 13:

NASA has made a strong point about carrying more than one “Commercial Provider” for the purpose of competition. It has also been reported that NASA is giving three additional flights to Space X, and one to Orbital, while a competition is in place for the follow on CRS-2 Commercial Cargo program - and yet it is reported that there will be a delay in awarding the CRS-2 contract.

- a. In the initial COTS program, competitions were offered and contracts awarded before the current suppliers of commercial cargo had fully developed launch vehicles. In light of that, why is there a delay in the CRS-2 competition?

ANSWER 13a:

CRS-2 is a complex procurement. The anticipated award date has been revised slightly, from June to September 2015, to ensure appropriate time for a thorough proposal evaluation.

QUESTION 13b:

Please explain the urgency for making four un-competitive awards given the Agency is prepared to make competitive awards in June for the very same services?

ANSWER 13b:

The additional CRS1 flights ensure continuity of service availability as we transition from the existing service requirements to the revised requirements of the CRS2 contract, which will need additional vehicle capabilities. The CRS1 flights will ensure service through 2017, and the CRS2 flights are anticipated to begin in 2018. The four additional flights are part of a competitively awarded contract.

QUESTION 13c:

Does the delay favor current contract holders instead of seeking the possibly best price for the taxpayer through competition?

ANSWER 13c:

No, the delay in the CRS-2 award does not favor current contract holders. CRS-2 is being implemented to ensure best value to the taxpayer through a full and open competition. Based on the robust competition, the additional time is considered essential for conducting any major source selection process such as this.

QUESTION 13d:

SpaceX has a backlog of launches, and Orbital is working to restore its launch service; if NASA is indeed providing four sole-source flights to these two companies, how is NASA going to ensure the timely launch of those payloads?

ANSWER 13d:

The contract provides for reviews and NASA insight to ensure the contractors are making progress. NASA only pays its CRS contractors when they meet contractually-defined milestones. In the event of a launch delay beyond 30 days, the CRS contracts contemplate that NASA can negotiate with the contractor to pursue an appropriate equitable adjustment to the contract terms.

Jason Mission

QUESTION 14:

The Jason-3 Mission has been waiting for a SpaceX certification of Falcon 9 and for a launch date. The Jason team has to be maintained during this down time.

- a. How have delays added to the Jason Program cost?
- b. Is Jason overrunning due to these delays?
- c. What other programs now have to contribute to covering these costs?

ANSWER 14:

The Jason-3 Project Team has worked diligently to minimize cost impacts from the launch delay by appropriately replanning tasks and associated staff hours. However, there has been a cost impact of roughly \$400K per month to the Jason-3 Project.

The Jason-3 Project has been mitigating the cost impacts associated with the launch delay by expending project reserves within the existing project budget. However, there will be an increase of the project life cycle cost. The project had planned on carrying over remaining reserves to cover engineering anomaly support during post-launch operations; the use of these reserves to offset costs associated with the launch delay will reduce the available funding for this purpose and result in an increase in total project life cycle costs.

No other programs have contributed to covering the costs; NASA has limited the impacts to just the Jason-3 Project.

Given the June 28 SpaceX Falcon 9 launch failure, NASA, working with its three partners NOAA, EUMETSAT and CNES, needs to understand the root cause of the failure and review a plan for return to flight.

Civil Servant and underutilized facility Costs

QUESTION 15:

Does NASA provide Civil Servant help and facility access outside of funded Space Act Agreements and contracts to commercial cargo and crew companies?

- a. What programs pay for these Civil Servants?
- b. Is it the Commercial Crew and Cargo Program?

ANSWER 15a&b:

In addition to funded Space Act Agreements and contracts, NASA has provided support for the development of commercial cargo and crew services through (1) unfunded Space Act Agreements and (2) fully reimbursable Space Act Agreements.

QUESTION 15c:

Do Exploration programs pay for any of them?

ANSWER 15c:

The Commercial Crew Program is part of the Exploration appropriation account, but is separate from Exploration Systems Development (ESD). The 21st Century Space Launch Complex is part of the Space Operations appropriations account.

QUESTION 15d:

Please provide the accounting of how much of this help is provided, for each company, and what accounts the funding comes from, including any funds taken temporarily or permanently from SLS.

Answer 15d:

The Commercial Crew Program has spent less than \$2.5 million, since inception, on civil servant labor for unfunded Space Act Agreements. This civil servant labor was primarily for NASA insight and milestone approval. The breakout by company is provided below. However, the United Launch Alliance (ULA) number is overstated since it includes labor costs related to both the funded CCDev1 and unfunded CCDev2 Space Act Agreements with ULA.

	\$ in Millions
United Launch Services	1.4
Excalibur Almaz Inc	0.1
Alliant TechSystems	1.0
<u>Total</u>	<u>2.5</u>

QUESTION 16:

Are Commercial Cargo and Crew Programs less expensive than traditional NASA Programs? How much of the cost difference is due to less NASA oversight and less use of NASA facilities? What programs are paying for these resources if they are not used by Commercial Programs? Please provide numbers of Civil Servants and support contractors supporting each human space flight program, including Commercial Cargo and Crew Programs and who covers their costs.

ANSWER 16:

The Commercial Crew Program is not yet complete; however, all indications are that it will be significantly less expensive than had NASA used a traditional development approach. Also, the Commercial Cargo project (COTS) was clearly less expensive.

There are many factors that contribute to the reduction in costs and it is not possible to attribute specific cost savings to individual factors. However, NASA believes that some of the factors that contribute to reduced costs are: industry sharing in the development costs as opposed to traditional NASA programs where the Agency pays 100 percent of the development costs; development schedules are generally shorter (limited new development and the ability for the developers to use existing technology designs results in shorter schedules) which contributes to costs savings; the use of fixed-price contracts and agreements as opposed to cost-plus contracts generally results in lower costs to the government provided the requirements are established. CCP phase 1 allowed for the requirements to be established; the overall reduction in the number of government requirements; and the allowance of the use of alternate standards.

NASA does not believe that less use of NASA facilities by the partners in CCP is a significant contributor to cost savings. The partners must reimburse NASA for the full costs of using our facilities. The streamlined insight/oversight approach used by CCP is generally more efficient than a traditional NASA development program, but it is unclear how significant that is to cost savings.

The civil servants (i.e., Full Time Equivalents, or FTEs) and contractor Work Year Equivalents (WYEs) for the Human Explorations and Operations (HEO) Mission Directorate are provided in the attachment.

QUESTION 17:

Since Civil Servant numbers remain steady, Programs must be allocated headcounts to pay for, whether they need the workers or not.

- a. Do SLS and Orion get a disproportionately large share compared to Commercial Crew and Cargo?

ANSWER 17a:

No. SLS, Orion, Commercial Crew, and commercial cargo only pay for the civil servants (i.e., FTEs) requested in their plans. The Advanced Exploration Systems (AES) heavily utilizes NASA civil servants to develop prototype systems and demonstrate key capabilities applicable to multiple missions and destinations to reduce the risk, lower lifecycle cost, and validate operation concepts. When HEO programs have available FTEs, AES is the primary funding and activity source to find new work for employees, providing NASA engineers and technologists hands-on experience with hardware, all while working to develop the technologies and systems needed for human exploration.

QUESTION 17b:

Is there a limit to how many commercial cargo or crew flights NASA will pay for early?

ANSWER 17b:

NASA pays its CRS contractors when they meet milestones based on ISS cargo delivery requirements. Commercial Crew Transportation Capability (CCtCap) contractors will also be paid when they meet milestones. Thus, NASA is not paying its contractors early, but upon completion of specified work. The timing for authorizing contractors to begin work for future flights depends on various factors, such as lead time for vehicle components, manifest needs, and development status.

QUESTION 17c:

If there is no limit, isn't NASA in fact subsidizing and maintaining a large private sector workforce instead of merely "paying for services" per launch?



Human Exploration and Operations Workforce FTE

FTE	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Human Exploration and Operations	5,144	5,031	5,028	5,032	5,032	5,031
Exploration	3,039	2,961	2,992	2,986	2,995	2,854
Exploration Systems Development	2,090	2,151	2,086	1,996	1,951	1,956
Orion Multi-Purpose Crew Vehicle	612	652	642	646	603	576
Space Launch System	912	924	878	807	799	824
Exploration Ground Systems	565	576	566	544	549	555
Commercial Spaceflight	246	331	324	185	182	0
Commercial Crew	246	331	324	185	182	0
Exploration Research and Development	704	479	582	805	862	899
Human Research Program	125	125	123	123	124	124
Advanced Exploration Systems	579	354	459	682	738	774
Space Operations	2,105	2,070	2,036	2,046	2,037	2,177
International Space Station Program	1,327	1,305	1,289	1,284	1,275	1,415
Space and Flight Support	778	765	747	762	762	762
21st Century Space Launch Complex	8	8	0	0	0	0
Space Communications and Navigation	262	251	234	236	234	234
Human Space Flight Operations	189	186	187	194	194	194
Launch Services	260	261	268	274	275	275
Rocket Propulsion Test	59	59	58	58	59	59

Totals may not add due to rounding



Human Exploration and Operations *Workforce WYE*

WYE*	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Human Exploration and Operations	14,061	13,670	13,047	12,207	11,192	10,650
Exploration	6,881	6,771	6,607	6,004	5,247	4,769
Exploration Systems Development Orion	6,530	6,426	6,296	5,697	4,943	4,494
Space Launch System	2,226	2,265	2,234	1,980	1,508	1,052
Exploration Ground Systems	3,138	2,883	2,763	2,612	2,493	2,493
	1,165	1,278	1,299	1,105	942	949
Commercial Spaceflight Commercial Crew	56	56	36	31	31	3
	56	56	36	31	31	3
Exploration Research and Development Human Research Program Advanced Exploration Systems	295	289	276	275	274	272
	146	146	145	145	143	141
	149	143	131	131	131	131
Space Operations	7,181	6,899	6,440	6,203	5,944	5,881
International Space Station Program	4,525	4,286	4,011	3,935	3,817	3,770
Space and Flight Support (SPS) 21st Century Space Launch Complex	2,656	2,613	2,430	2,268	2,128	2,111
	132	90	1	0	0	0
Space Communications and Navigation Human Space Flight Operations	1,993	2,000	1,911	1,749	1,610	1,594
	151	151	146	146	146	146
Launch Services	208	200	200	199	199	199
Rocket Propulsion Test	172	172	172	172	172	172

*WYE not reportable under Space Act Agreements or Fixed Price Contracts
Totals may not add due to rounding

ANSWER 17c:

Please see response to Question #17b, above.

Commercial Crew competition

QUESTION 18:

Please describe whether the exclusive use of Pad 39A by Space X weighed in their favor in the competition.

- a. Was the exclusive use of a launch pad announced as a point of comparison?

ANSWER 18a:

All aspects of an offeror's concept of operation were evaluated by NASA, including the company's launch facility. Additionally, we considered each company's ability to execute their proposed plan. Exclusivity was not a point of evaluation.

QUESTION 18b:

If it was not announced as part of the criteria, was it at some point discovered by industry before NASA did eventually announce it?

ANSWER 18b:

Exclusive use of a launch site was not part of the evaluation criteria.

QUESTION 18c:

Did failure to maintain a publicly-announced launch schedule over a period of years count as a negative? If not, why not?

ANSWER 18c:

Evaluation of schedule performance was considered under the criterion of Past Performance. Negative schedule performance for all offerors was considered in making selection of the CCtCap awardees.

QUESTION 18d:

If it did not count, are you enacting payment penalties for delayed services in the future? If not, why not?

ANSWER 18d:

Please see response to Question #18c, above. The contract provides for adjustments, in price or other consideration, if either the contractor or the Government delays a launch beyond the specified grace period.

QUESTION 18e:

If you are very confident in the future launch schedule, does the taxpayer not have the right to expect either timely launches or reimbursement for delayed launches?

ANSWER 18e:

In human spaceflight, NASA has committed to safety as our primary concern. A late launch is far preferable to a mishap or accident that threatens the lives of the crew or ground personnel. NASA strives for efficient launch services, meaning on time and on budget, while maintaining safety foremost.

QUESTION 18f:

What would be the cost of focusing on one commercial crew provider, based on technical readiness, to ensure that we can safely launch American astronauts on American vehicles by at least late 2017?

ANSWER 18f:

The Commercial Crew Program (CCP) has two providers developing a U.S.-based human launch system. The advantages of this arrangement are many. Using competition as our tool, these companies will strive to surpass their competitors in safety and technical superiority, while maintaining schedule. The use of firm, fixed price contracts minimizes the cost risk to NASA. Allowing the companies to find innovative solutions to meeting these contract requirements is the most efficient method to ensure that NASA safely launches its astronauts from American soil as soon as possible. Reducing to one provider eliminates all these competitive pressures and may actually be less effective than having two competing providers.

TCAT

QUESTION 19:

What is the status of TCAT and what reductions are planned?

- a. Will Center Directors have an opportunity to review reductions beforehand and to make suggestions on revision of the plan?

ANSWER 19:

In 2014, NASA embarked on an effort to strategically address the technical capabilities required to support Agency goals. Referred to as the Technical Capabilities Assessment Team (TCAT) and championed by the NASA Associate Administrator, this disciplined effort enabled NASA leadership to make informed decisions about both investing and divesting in order to ensure that the agency has the right mix of people and assets to carry NASA's mission forward. The TCAT effort involved participation from all ten NASA Centers and four Mission Directorates, as well as the senior managers now responsible for executing the decisions and results. While TCAT started as an initiative, it is now fully instituted as part of NASA's operating model, so that technical capabilities are assessed annually.

Of the 18 total technical capabilities assessed through the TCAT efforts, 11 formal decisions resulted, as noted below. To date, these TCAT-based decisions encompass approximately a 13,000-person workforce and potential for annual reinvestment opportunities totaling ~\$600M.

Decisions Table:

Microgravity Flight Services	Life Sciences Research
Balloons	Earth Science
Aircraft Operations	Human Factors
Mission Operations	Nuclear Power and Propulsion
Environments Testing	Propulsion
	System-level Capabilities: Entry, Descent, and Landing; Rendezvous and Capture; In-Situ Resource Utilization

Some of these decisions resulted in tactical changes, such as dispositioning of 13 aircraft, eliminating internal microgravity flight operations, and updating external and internal memorandums of agreement. Many of the decisions initiated further review and analysis by subject matter experts, with results to be reported in FY 2015. These more detailed reviews currently underway include:

- *Balloons* — to consider alternative approaches for NASA to satisfy the requirements for balloon launches, including use of NASA Center capabilities or a commercial provider. This would allow divestment of a satellite NASA facility, allowing the Agency to shrink its footprint.
- *Earth Science Distributed Active Archive Centers (DAACS)* — to study potential efficiencies and enhanced capabilities based on science discipline and optimizing common data operation tasks across Centers.
- *Mission Operations* — to establish a future mission operations approach and corresponding implementation plan with the goals of lowering NASA costs and reducing related facilities and infrastructure.
- *Environments Testing* — to identify opportunities for divestment in NASA's space environments testing portfolio, while recommending a centralized management model for savings and efficiency.

Until these reviews are completed, resulting divestments and investments to workforce and infrastructure cannot be specified with great fidelity. However, future budget cycles will reflect the results, once approved through Agency governance processes. The NASA governance structure uses the Mission Support Council (MSC) to address recommendations if appropriate decision thresholds are met, particularly with respect to facilities, workforce, and contracts. The MSC includes membership from all the NASA Centers and follows a thorough documentation review and vetting process prior to council decisions.

As mentioned earlier, in addition to the opportunities for gaining efficiencies based on individual assessment topics, the TCAT effort resulted in improving NASA's operating model. The Capability Leadership Model was established to enable *stewardship* of NASA's critical capabilities, *awareness* to senior management of capability health, and *sustainment* of Center capabilities to meet mission needs. The model approach targets those capabilities that need (a) a greater coordination and alignment across Mission Directorates and Centers, and (b) an integrated strategy toward advancement for future Agency objectives. Capabilities are designated in the following categories: disciplines, systems, research, and services. Note that the assessment decisions bolded in the table above specifically identified the application of capability leadership. This new construct allows for agency insight and advice around a capability's technical content, tools/methods, workforce skills, asset utilization, and external disposition. Additional details of this Technical Capability Leadership model is available upon request, as well as communications on the broader positive impacts of the TCAT effort within NASA.

Commercial Crew Certification and Safety

QUESTION 20:

Space X has continued to modify the Falcon 9 while flying cargo missions. NASA has not, apparently, viewed these modifications as reasons to review certification.

- a. Was NASA notified of the details of these modifications and asked for input before the launch of NASA payloads?

ANSWER 20a:

The Commercial Resupply Services (CRS) contracts provide for detailed definition and discussion of the configuration and changes to the launch and in-flight spacecraft configurations. Each change is evaluated against contractual mission requirements for each flight.

QUESTION 20b:

Will you allow a similar process of modifications, by either contractor, once they begin launching astronauts?

ANSWER 20b:

System modifications to upgrade performance, enhance safety, correct identified problem areas and improve efficiency will be considered during performance of the missions under CCtCap. Each modification will be examined separately, for any safety impacts to the integrated system and individually approved by the Commercial Crew Program.

QUESTION 20c:

How will you certify the vehicle safety, when the design is constantly changing?

ANSWER 20c:

For post certification missions, there are two times when NASA formally addresses this, although it is continuously under surveillance through the NASA insight process. At Mission Integration Review, the contractor presents design changes from the last mission and supporting analysis that the revised design will meet mission requirements. At the Mission Certification Review, all revisions are carefully examined to ensure that they have been fully verified to meet NASA requirements and the modified system is certified by NASA.

QUESTION 20d:

How does the NASA process for design changes in the commercial crew program compare to the practice employed in the Space Shuttle Program?

ANSWER 20d:

The process is much the same, however the parties fulfilling each step of the process may be different. The contractors perform much of the preliminary analysis and test of design modification and make their own assessment of it. Then the results of this are presented to NASA. Under Space Shuttle, NASA would have authorized and overseen each of the earlier analysis and test steps, as well as performed the later review and approval step.

QUESTION 20e:

Mr. Administrator, is this an accurate quote from you, of March 11, at the Goddard Space Symposium? "It's a great time to be in this business. But also: we're going to see some failures, going to lose some people."

ANSWER 20e:

This quote was not from a prepared speech, and there is no NASA transcript. The Administrator was emphasizing that human spaceflight remains a rewarding, but still risky, business.

QUESTION 20f:

Was that from a prepared speech? Can I obtain a copy of the speech?

ANSWER 20f:

This quote was not from a prepared speech, and there is no NASA transcript. The Administrator was emphasizing that human spaceflight remains a rewarding, but still risky, business.

QUESTION 20g:

Also, I have sat in past CJS hearings in which you assured Congress that there would be no diminishment in NASA's commitment to safety as NASA moved to using commercial services. How do you explain this comment?

ANSWER 20g:

The Commercial Crew systems NASA uses will have to meet the same or equivalent safety requirements as the Agency's deep space human spaceflight systems (i.e., SLS and Orion). The Agency will not fly its astronauts on transportation systems that do not meet its safety requirements. The Administrator's comments at the 2015 Robert H. Goddard Memorial Symposium reflect that fact that human spaceflight, both government and commercial, remains a risky endeavor.

QUESTION 20h:

If one provider is willing to meet standards and spend company money on safety, more than another company does, do you weigh the added safety measures into the equation when you make contract choices?

ANSWER 20h:

All offerors were required to propose an acceptable approach to meeting NASA's safety standards. If an offeror proposed an approach that exceeded NASA safety standards, the evaluation of this could result in a positive finding, enhancing the competitiveness of the proposal.

QUESTION 20i:

The ASAP in its annual report strongly criticized NASA and the HQ Commercial Programs manager for refusing to provide data needed for the ASAP role in the certification process. This issue was reiterated by Admiral Dyer, the chair of the ASAP in a recent hearing. How did this go on for so long?

ANSWER 20i:

In order to protect the integrity of the procurement process, the Agency needed to control the data it released following award of the initial Certification Products Contracts and after the award of the follow-on CCTCap contracts. The CCTCap procurement blackout and protest period caused the Agency to restrict data and product releases to all parties for an extended period of time of almost one year. Protecting the procurement process was paramount and helped ensure the best selection for the Nation was made. After the protest was concluded and a public decision was released by the GAO in January 2015, NASA took immediate steps to brief its key stakeholders, Congress, the Aerospace Safety Advisory Panel (ASAP), and the public about Commercial Crew contract details. Please note that the ASAP provides invaluable review and advice but it is not part of NASA's crew certification process.

QUESTION 20j:

What were the repercussions for the individual responsible?

ANSWER 20j:

Please see response to Question #20i, above. The reduction in access to data was due primarily to the ongoing contract competition. Thus, there was no fault involved on the part of any individual; NASA was abiding by established procurement rules.

RD-180

QUESTION 21:

Administrator Bolden, as you know, while Russian engines, specifically the RD-180, are banned after a certain date for use on EELV launches of national security payloads. However, RD-181 engines, which I think are made at the same Russian factory, are still allowed for non national-security payloads. Do you support continued use of the RD-180 engine for NASA missions, as this engine supports one of your two commercial crew providers?

ANSWER 21:

In general, with respect to commercial cargo and crew support to ISS, as well as launch services for NASA and other civil-sector satellites, NASA expects its commercial providers to propose and provide launch solutions that are consistent with national policy, and for our commercial cargo and satellite launch service providers to meet their contractual commitments. Specifically on the RD-180 question, NASA accepts the continued use of the RD-180 engine by ULA until their alternative launch vehicle is available.

International Space Station ISS**QUESTION 22:**

Have the Russians signed agreements to support the Space Station with flights and funding beyond 2020?

ANSWER 22:

Since the initial public declarations concerning Russia's participation on ISS, there have been multiple public indications that Russia will continue participating in the ISS program through 2024. Roscosmos has publicly commented that they expect to receive government authority later this summer to continue ISS beyond 2020.

The ISS partnership Intergovernmental Agreement and Memoranda of Understanding do not need to be modified to reflect ISS extension beyond 2020.

QUESTION 22a:

What other countries have offered to spend money on support of the ISS beyond 2020?

ANSWER 22a:

In addition to the United States, the Government of Canada announced in the release of their FY 2015 budget that Canada will continue its participation in the ISS to 2024. In the case of Russia, as noted above, since the initial public declarations concerning Russia's participation on ISS, there have been multiple public indications that Russia will continue participating in the ISS program through 2024. Roscosmos has publicly commented that they expect to receive government authority later this summer to continue ISS beyond 2020. The Government of Japan has also indicated that its decision to support ISS operations beyond 2020 will likely be made in the future after internal government deliberations are completed. The European Space Agency is expected to address ISS operations and utilization beyond 2020 at their ministerial meeting in late 2016. The ISS Partners have expressed support for continuing research on ISS, and see tremendous benefit for extended research opportunities.

QUESTION 22b:

What is NASA doing to decrease the support costs of the ISS?

ANSWER 22b:

Since the ISS was extended to 2020 in 2011, NASA has reduced the ISS O&M budget through a combination of efficiencies in sustaining activities, some content reductions and cutbacks in operations overhead. NASA continues to look for further efficiencies in the ISS O&M budget. Ongoing activities to responsibly lower the O&M cost of the ISS include changes to our 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 2016 President's budget request.

QUESTION 22c:

Has NASA done a cost study to compare buying or leasing privately sourced habitats instead of maintaining legacy pieces of the ISS?

ANSWER 22c:

NASA intends to transition out of the ISS near its end of life to commercially provided low Earth orbit (LEO) platforms and capabilities. NASA does not plan to continue to maintain the Government-sourced ISS pieces or elements beyond its end of life.

QUESTION 22d:

What is the total amount of money paid to the ISS/NASA in the last three calendar years (2012, 2013, 2014) by companies in order to conduct experiments on the station?

ANSWER 22d:

Companies do not pay NASA to conduct experiments on ISS. The use of ISS as a National Laboratory by corporate and other non-NASA entities is managed by the Center for the Advancement of Science In Space (CASIS). NASA provides payload manifesting, support by a NASA PIM (Payload Integration Manager), payload delivery to the ISS, on-orbit resources (including crew time, power, data, etc.), payload return (if required), and in some cases assistance with payload integration services, at no charge. National Lab users must pay to develop their experiments, and cover costs for their Principal Investigators both pre- and post-flight.

QUESTION 22e:

Is the private sector, business world showing an increasing interest or decreasing interest in terms of willingness to spend money getting their experiments up to the ISS?

ANSWER 22e:

Use of the ISS as a National Laboratory has increased significantly since FY 2012, which was the first full year of operations by the Center for the Advancement of Science in Space (CASIS), the operator of the lab. In recent ISS increments, CASIS has been reaching its allocation of National Lab resources and it expected to continue for the foreseeable future. The growth is coming from non-traditional areas, specifically from the commercial sector. Commercial projects for research and technology development on the ISS National Lab have increased from 3 in FY 2012 to 107 in FY 2014. This includes such industry leaders as Merck, Novartis, and Eli Lilly. Expanded capabilities, such as the ability to conduct model organism research on the ISS, using rodents as well as other organisms, has helped draw this interest. It also includes perhaps

the largest purely commercial provision of services using the ISS, the deployment by NanoRacks of dozens of Dove cube satellites for Planet Labs. Similarly, use by other government agencies, including NIH and DOD, has also begun to broaden, totaling 11 investigations in FY 2014. Finally, investigations from academic institutions went from 31 in FY 2012 to 90 in FY 2014. Grant funding for research through the National Lab continues to grow, from \$2.1M in FY 2012, to \$5.9M in FY 2014. The International Partners are also seeking to expand the base of researchers using their assets on the ISS. This will expand research, and commercial participation, in low-Earth orbit.

LC-39A

QUESTION 23a:

Administrator Bolden, last year SpaceX was awarded a twenty-year lease on Launch Complex 39A (LC-39A) at NASA's Kennedy Space Center, the sister pad to the 39-B which is being readied to launch the Space Launch System. SpaceX has announced the intent to use this launch pad for commercial crew and Falcon heavy. These two launch pads use a common launch control complex which includes state of the art launch control computers and communications systems.

- a. Will SpaceX be using this common launch control complex?
- b. What is the total cost of the control center?
- c. Are NASA SLS expenditures in the launch control center going to be used by SpaceX?
- d. How much is SpaceX paying towards the control center and/or for its use? Have those funds been paid to NASA?
- e. Has NASA spent any other funds on work on LC-39A, either exclusively on that pad, or on work which goes through that campus or is shared with that campus?

ANSWER 23:

NASA currently pays ~\$1.5M per year in operations and maintenance costs for the LCC. Post the retirement of the Space Shuttle program, the capability of the KSC Launch Control Center was streamlined to support SLS and Orion requirements. Although the LCC could accommodate multiple launch complex users, additional investments would be required by other users to upgrade the command and control infrastructure to support requirements unique to their launch vehicle.

- a. SpaceX will not be using the KSC Launch Control Center (LCC) for launches off of LC39A.
- b. SpaceX plans to build their own LCC elsewhere on KSC. The location has not yet been identified.
- c. There will be no NASA expenditures for the SpaceX LCC.
- d. SpaceX will not be paying NASA for use of the NASA LCC as they do not plan to use it.
- e. NASA has not spent any funds for work on LC-39A or any other SpaceX facilities.

Science**QUESTION 24:**

What would the benefits be, in terms of speed of information returned, payload size and design benefits, and other factors, of using the SLS as the launch/mission vehicle for a robust mission to Europa?

- a. When does that decision need to be made in order to fully assist the mission planners?

ANSWER 24a:

At this time, the space science decadal surveys have not identified any science missions over the decadal timeframes that would require SLS. For Science Mission Directorate Europa mission planners, the earliest a decision regarding launch vehicle selection would be needed is before Preliminary Design Review in 2018.

QUESTION 24b:

I am assuming there are no barriers to designating the SLS as the launch vehicle. If there are, please provide the report or bill language needed to eliminate any such problem.

ANSWER 24b:

NASA would assess the total cost of launching a science mission on SLS compared with other launch vehicle options and would follow applicable statutory and policy direction that the USG refrain from competing with commercial launch services.

Current law, Title 51 USC sections 50131 and 50132, requires the U.S. Government to use domestic commercial space transportation services for the launch of U.S. Government payloads. The law also allows the NASA Administrator to determine whether one of the exceptions provided in the law, that would allow the use of a domestic non-commercial space transportation service, applies.

Technology and other matters**QUESTION 25:**

The CATALYST program is providing a good model of carefully managed and audited potential partnership between companies which provide substantial capital of their own in exchange for some government funding partnership assistance.

- a. Please provide information on what plans you have to support this program and what funds in the Technology directorate might be directed here.

ANSWER 25a:

In 2014, NASA introduced an initiative called Lunar CATALYST (“Lunar Cargo Transportation and Landing by Soft Touchdown”) and entered into competitively awarded partnerships with three U.S. firms to provide in-kind support to develop commercial lunar robotic landing capabilities. The purpose of the initiative is to encourage the development of U.S. private-sector robotic lunar landers capable of successfully delivering payloads to the lunar surface using U.S. commercial launch capabilities. The Human Exploration and Operations Mission Directorate’s Advance Exploration Systems (AES) Division is leading this initiative. NASA does not provide funding to partners under CATALYST.

The Lunar CATALYST partnerships are being executed via no-funds-exchanged Space Act Agreements (SAA) with three companies:

- Astrobotic Technology;
- Masten Space Systems; and,
- Moon Express.

SAAs with these companies, which were competitively selected on the basis of their proposed technical approach, financial plan, and commercialization strategy, were signed in September 2014, and have a nominal term of three years. Through Lunar CATALYST, NASA is providing partners with in-kind contributions including technical expertise, access to test facilities, software, and the loaning of equipment.

NASA recognizes that private-sector investment in technologies intended to enable commercial lunar activities, at least initially with respect to U.S. and other nations’ exploration activities, has been increasing and anticipates that industry will eventually be able to provide commercial cargo transportation services to the lunar surface to both public and private customers. Commercial lunar transportation capabilities could support science and exploration objectives such as sample returns, geophysical network deployment, resource utilization, and technology advancements.

NASA AES Division provides \$9-11 million per year total in in-kind support to the three partners. NASA does not currently have a plan to augment this effort using resources from the Space Technology Mission Directorate as it is meeting the request level of support for all three companies.

For more information about the Lunar CATALYST initiative, visit: www.nasa.gov/lunarcatalyst

QUESTION 25b:

As the Chairman noted in this year's hearing, there is growing interest in advanced propulsion, of the kind which represents a leap forward from today's combustion engines. What plans are there to provide more support to nuclear engine work?

ANSWER 25b:

As part of the Human Exploration and Operations Mission Directorate's Advanced Exploration Systems (AES) Division activities, a project was initiated in 2012 to develop and test reactor fuel elements, a critical nuclear thermal propulsion (NTP) technology development challenge, leading to a recommendation by a joint Department of Energy (DOE) and NASA independent review board in early 2015 to have a primary focus for future fuel development on graphite composite type NTP fuel materials with a secondary focus on cermet materials. The project has also conducted preliminary nuclear rocket engine concept development and initial assessments of affordable nuclear ground test methods for NTP. For the remainder of FY 2015, the project will conduct more rigorous fuel element fabrication and testing of the composite fuel elements. For FY 2016 and 2017, the project plans to work with the DOE to incorporate enriched uranium into the selected material and fuel elements and eventually test active fuel element(s) in a reactor to investigate the effects of radiation on material performance. The NASA Marshall Space Flight Center (MSFC), in partnership with DOE is leading this project with the Glenn Research Center (GRC) also providing a significant support role. Meanwhile the Space Technology Mission Directorate (STMD) is supporting NTP capabilities with the eCryo project that is advancing our ability to perform long-term in-space storage of liquid hydrogen, a required capability for NTP. STMD is also support early stage efforts in the NTP area under the Center Innovation Fund (CIF) program at both MSFC (High Fidelity Design Tools and a New Hydrogen Containment for Nuclear Thermal Engine Ground Testing) and the Stennis Space Center (SSC) (Development & Validation of Propellant Detonation and Propagation Modeling Methods; and Large Propellant Tank Cryo-Cooler Demonstration.

NASA does not expect to require advanced propulsion technologies such as NTP in the initial crewed missions to the Mars system. Other advanced propulsion technologies such as high-powered solar electric propulsion (SEP) that is planned to be demonstrated on the Asteroid Redirect Mission, combined with chemical systems, meet the needs of U.S. commercial aerospace industry while serving as the core capabilities for the initial in-space propulsion system for the Mars crewed missions. NASA is still in the process of conducting Mars Vicinity Trades for in-space propulsion and trajectory analysis and will not make a final decision on final Mars transportation architectures and mission selections until no earlier than 2020.

QUESTION 25c:

What plans are there to support fusion energy research (currently underway on the campus of Redstone Arsenal) and perhaps similar projects elsewhere.

ANSWER 25c:

The Space Technology Mission Directorate's NASA Innovative Advanced Concepts (NIAC) program nurtures visionary ideas that could transform future NASA missions with the creation of breakthroughs such as fusion energy. The intended scope for NIAC projects is for Technology Readiness Levels 1-2 or early 3. STMD competes all early research selections in NIAC and CIF, rather than formally planning specific activities. The NIAC program has supported some fusion energy propulsion studies in the past, but none currently, and none at the Redstone Arsenal.

Specific past examples include:

- 2011 NIAC Phase I Study – The Fusion Driven Rocket (MSNW LLC)
- 2011 NIAC Phase I Study – Aneutronic Fusion Spacecraft Architecture (University of Houston at Clear Lake)
- 2012 NIAC Phase II Study – The Fusion Driven Rocket (MSNW LLC)
- 2013 NIAC Phase I Study – Pulsed Fission-Fusion Propulsion System (NASA MSFC)

STMD has also supported, and is currently supporting, a few early research projects in other nuclear propulsion ideas under both NIAC and the Center Innovation Fund (CIF). These include:

- 2011 NIAC Phase I Study – Concept Assessment of a Fission Fragment Rocket Engine (NASA MSFC)
- 2012 CIF Project: Dusty Plasma Fission Fragment Propulsion Project (NASA MSFC)
- 2013 CIF Project: Fission Fragment Dust Experiment (NASA MSFC)
- 2014 CIF Project: Pulsed Plasma Transit System (NASA ARC/JPL)
- 2015 CIF Project: Dust Grain Charging Experiment for a Fission Fragment Rocket Engine (NASA MSFC)
- 2015 CIF Project: Pulsed Plasma Transit System (NASA ARC/JPL)

CJS Appropriations Subcommittee Hearing March 4, 2015
Questions for the Record
Rep Honda to Administrator Bolden

QUESTION 1:

NASA's FY 2016 Budget Request notes that NASA plans to hold a senior review for SOFIA in Spring 2016. SOFIA just became fully operational in February 2014 and was in Germany for a good portion of last year undergoing a heavy maintenance visit. It seems like NASA and OMB are setting SOFIA up to fail.

- a. Why has NASA proposed a senior review for this mission less than two years after it became fully operational, particularly when most NASA missions do not have a senior review until the mission has been operational for five years?

ANSWER 1a:

Given that SOFIA has existed since the 1990s, the Administration believes that a Senior Review would provide useful insight on the program. Additionally, SOFIA's operational costs are relatively high (only Hubble has higher annual operations costs among operating astrophysics missions). Therefore, a Senior Review could provide insights not only on ways to optimize this asset but also whether this high-cost asset is producing high-quality science that is a good return on taxpayer dollars.

QUESTION 1b:

How do you expect NASA to make an assessment of the scientific productivity of SOFIA only two years after it has become fully operational, especially in light of the fact that there were no observations that could be made during the heavy maintenance visit in Germany, and it takes much longer than this timeframe for researchers to propose, make observations, analyze their data, and prepare and submit papers for publication?

ANSWER 1b:

Since the purpose of SOFIA's inclusion in the Senior Review is to assess the value of continued science operations in light of its high operating costs, the review will concentrate on the quality and scope of scientific research that SOFIA enables. By the time of the 2016 Astrophysics Senior Review, SOFIA will have accumulated a body of work that will include: 1) completion of Cycle 3 observations, including a second deployment to the Southern Hemisphere; 2) published results from Early Science, Cycle 1 and Cycle 2 in refereed journals, and presentation of these results at conferences worldwide; 3) demonstrated scientific output from all six first-generation science instruments and engineering flights of the second-generation instruments (upGREAT and HAWC+); and, 4) finishing the phase 1 selection process for a new 3rd generation science instrument. Combined together, these activities should be sufficient to make an assessment of the present and future scientific productivity of SOFIA.

QUESTION 1c:

Germany built the telescope in SOFIA, contributed other components, and pays 20 percent of the operating costs. Did SOFIA's German partners participate in this proposed scheduling for a premature senior review or did they learn of it upon reading the President's Budget Request?

ANSWER 1c:

NASA informed its German partners at DLR about the SOFIA Senior Review through the normal annual process of informing our international partners regarding the content of the President's budget request. DLR did not participate in the decision to review SOFIA in 2016. DLR understands the need to review SOFIA's science value and is participating, through the German SOFIA project, in preparing the SOFIA project for the review.

QUESTION 1d:

Observatories depend on updating the instruments and cameras to insure the facility remains competitive and productive. Will NASA be following through with plans to begin selection and development of the next round of instruments for SOFIA?

ANSWER 1d:

Notice of intent to procure the third generation SOFIA science instrument was published on April 6, 2015. Contingent on a successful Senior Review, the goal is to select a third generation SOFIA instrument and commission the new instrument selected in the 2018 time frame in order to minimize the time between SOFIA technology upgrades. The timeline for future science instruments (generation 4) will be influenced by the findings of the Senior Review currently scheduled for 2016. Subject to endorsement by of the Senior Review, the program plans to deploy new instrumentation capability on a 3-year timeframe.

QUESTION 2:

I am looking forward to supporting a NASA led mission to explore Europa. The use of secondary payloads on the Europa mission, say to fly through Europa's geysers and water plumes to directly search for life in the plums or under the surface, could be an inexpensive, low-risk opportunity to increase the scientific capabilities of the mission.

- a. What are NASA's plans to use secondary payloads on a Europa mission to hunt for alien life?
- b. What is the current timeline for the Europa mission? When does NASA anticipate formalizing a call for mission concept designs?

ANSWER 2:

For the first time, the President's FY 2016 budget request includes a five-year budget profile to formulate a new mission to explore Europa. Following NASA's February 2014 Strategy Implementation Planning (SIP) meeting which directed SMD to begin developing a mission to Europa, a pre-Acquisition Strategy Meeting (pre-ASM) was held in January 2015. Key decisions from the pre-ASM included that the overall mission is to be directed to JPL and will be a multiple flyby mission in orbit around Jupiter, with orbits designed to provide near global coverage of the surface of Europa. Given this, there will not be a call for mission concept designs. JPL and their extended teams have been refining mission concepts for many years and the multiple flyby concept has been selected. The instruments for the Europa mission have been selected and include instruments that could examine particles ejected from Europa such as plumes. As part of the mission's formulation phase, NASA will assess the potential for secondary payloads. Given the potential for a secondary payload to add cost, risk, and complexity to the mission, NASA would have to determine whether a secondary payload is feasible and worth the added cost, risk, and complexity. We believe the Europa mission could be launched in the mid-to-late 2020s if the scope and mission concept remain stable, and if funding is provided consistent with established budget profiles.

QUESTION 3:

ISS users, including commercial companies, are rapidly increasing the amount of payloads they are sending to the International Space Station. In the ISS program, the "ISS Research" line is over \$300 million, yet the majority of this funding is being used by NASA for various operational programs and not to conduct research. In recent years, less than 20 percent of the funding for "ISS Research" is being used for biological and physical ISS research.

- a. The following report language was included with the final FY15 CJS bill: "NASA's budget request continues to allocate insufficient funding and effort to ISS research. The apparent increase in the request for research funding is only due to the transfer of in-space robotic servicing work from the ISS operations budget, and nearly 60 percent of total research resources are dedicated to logistical support rather than research activities. The Committee believes that this imbalance must be addressed, with a greater share of research funding going to actual physical and biological science research, and directs NASA to develop a strategy for accomplishing this goal over the next five fiscal years. This strategy shall be provided no later than 120 days after the enactment of this Act." What is the status of this report?

ANSWER 3a:

This report is currently in work, and we anticipate delivering it to Congress in the near future.

QUESTION 3b:

What is NASA's plan to ensure that ISS has sufficient funding and astronaut time to handle the increasing number of science experiments?

ANSWER 3b:

The President's FY 2016 budget request supports a diverse program of research aboard the International Space Station (ISS). In addition, the Center for the Advancement of Science In Space (CASIS) is managing the National Laboratory aspects of Station research. Crew time available for the conduct of experiments is an ongoing challenge, and one which will be mitigated once astronauts begin flying to ISS aboard U.S. commercial crew vehicles by the end of 2017. This will enable an increase in the total ISS crew size from six to seven crewmembers, with the seventh crewmember focused on conducting research. NASA estimates this will roughly double the number of hours dedicated to research aboard Station.

QUESTION 4:

The FY 2016 budget request includes a proposed decrease of 200 civil servants. I continue to hear from NASA Center directors and staff about the continuing drop in number of civil servants and the detrimental effects this is having on the Centers' ability to accomplish their missions. At some NASA Centers, the civil-service workforce is less than a third or even a quarter of the total Center workforce. As OMB and NASA continue to cut the number of Civil Servants, NASA Centers are forced to hire contractors at greater cost. This leaves the already strapped Centers with even less money to fulfill their mission. It seems counter intuitive that we are not investing more into our human resources at a time when NASA is continuing to ramp up multiple long-term personnel intensive programs.

- a. What is NASA doing to protect its civil servant workforce and ensure that the NASA Centers have the ability to hire and retain the best and the brightest scientists and engineers?

QUESTION 4:

In the FY 2016 budget request, the decrease of 200 FTE - a little over one percent of the civil service population - helps to balance the programmatic needs for civil service talent with the Centers' need to refresh the workforce. Several missions, including the Human Exploration and Operations and Space Technology Programs, seek balance between civil service and contractor workforce so they can alter the size and skill mix of the workforce as their projects move to new phases, and also maintain a base of civil service expertise for development projects. In addition, NASA values the synergy gained in teaming the workforce with industry and academia to share knowledge, improve collaboration, and leverage solutions to shared challenges. Given estimated civil service attrition rates, we expect every Center will be able to do some hiring even with the proposed FTE reductions. Therefore, all Centers are able to make some progress in refreshing their civil service talent base and altering the skill mix to match future needs, particularly in the science and engineering fields.

NASA consistently looks for opportunities to provide work to civil service employees and, when appropriate, reduce the ratio of contractors to civil servants. At the end of FY 2014, the Agency ratio of on- and near-site contractors to civil service FTE was less than 1.5 to 1, with 27,700 contractor WYE (not including JPL) to 17,500 civil service FTE. In fact, the ratio of contractors to civil servants has reduced significantly since 2010 when it was 2.4 to 1. In this time period, the civil service workforce reduced by around 725 FTE while the contractor population reduced by more than 15,000 WYE. Thus, both segments of the workforce have become smaller, but most of the reductions have been made in the contractor population.

Representative Kilmer
Questions for NASA

QUESTION 1:

To what extent has the Administration evaluated the benefits of administering space grants at the state-wide consortia level versus at the national level? If NASA has evaluated this question, what benefits do the state-wide consortia bring to bear?

ANSWER 1:

While NASA has not evaluated the benefits of administering space grants at the state-wide consortia level versus at the national level, the National Space Grant Foundation has produced a 25th Anniversary Book about the Space Grant consortia that highlights accomplishments or benefits in each state available on line at:

<http://www.national.spacegrant.org/uploads/PDF/SpaceGrant25thAnnivBook.pdf>

NASA's FY 2016 budget request makes a quick reference to the Space Grant Program's contract for evaluation technical assistance with Paragon TEC Inc. Cleveland, OH. Paragon TEC is consulting the Consortia and other stakeholders regarding the scope or plan for a future Space Grant evaluation, reporting burden on each state's Space Grant Consortium, and other interests. A *February 2015 Space Grant Evaluation Update* provides specific details and is available online at:

http://www.nasa.gov/sites/default/files/atoms/files/space_grant_evaluation_update_2-27-15.pdf.

QUESTION 2:

Administrator Bolden, congratulations to the NASA team on the successful Exploration Flight Test 1 (EFT-1) of the Orion multi-purpose crew vehicle last December. The successful test flight heralds the first step on our journey to Mars. So I, as many in Congress, are anxious to see continuing and measurable progress. The Space Launch System, which is a key building block in our ability to explore deep space with humans, was appropriated \$1.7B for FY 2015. In your budget request for FY 2016, the amount for SLS is reduced to \$1.36B. As I understand it, the FY 2015 appropriation enables the consideration of having an Exploration Upper Stage ready for the first crewed mission, currently envisioned for around 2022. Mr. Administrator, your FY 2016 budget justification indicates that the FY 2016 budget enables a launch readiness capability for EM-1 of late 2018.

- a. Does the 5-year budget run out in the FY 2016 budget request enable a crewed EM-2 flight in 2022?

ANSWER 2a:

NASA will establish an integrated Exploration Mission-1 (EM-1) launch planning date after all element Critical Design Reviews (CDRs) are complete (i.e., for Orion, the Space Launch System

[SLS], and Exploration Ground Systems). The President's FY 2016 Budget Request supports a crewed EM-2 flight in FY 2021-22. The integrated launch planning date for EM-2 would be set following the EM-1 mission.

QUESTION 2b:

Does the 5-year budget run out enable the development of a new Exploration Upper Stage that can be used for that 2022 EM-2 flight?

ANSWER 2b:

No. The FY 2016 President's budget request assumes the same Block 1 SLS configuration with an Interim Cryogenic Propulsion Stage (ICPS) for EM-2 as for the first flight on EM-1.

QUESTION 2c:

If not, what increases to the budget run out would enable the Exploration Upper Stage to be available for that 2022 EM-2 flight?

ANSWER 2c:

Exploration Upper Stage (EUS) is one element of an integrated Block 1B SLS configuration that would also include upper stage engines, a new stage adaptor, as well as associated changes to ground system elements. Estimates to date for development through first flight of a Block 1B SLS with EUS (including the procurement and integration of upper stage engines, a new universal stage adaptor, vehicle integration, and ground modifications) have been in the range of \$1.5-2B. However, those estimates are very preliminary, and not based on a level of design maturity where NASA would normally provide cost ranges.

QUESTION 2d:

If the Exploration Upper Stage is not used on EM-2, what would be the impact in terms of capabilities, types of missions and potential destinations?

Answer 2d:

EM-2 will fly approximately the same mission as EM-1, into cis-lunar space, but with crew aboard. For this mission, a Block 1B SLS with an Exploration Upper Stage (EUS) is not required.

QUESTION 3:

Representing a coastal district, I support NASA's earth science mission and your work on erosion coastal erosion and earthquakes. Would you be able to share with us some of the key successes NASA is looking forward to making in this arena this coming year?

ANSWER 3:

Coastal Research – NASA is supporting new and innovative science research to detect and track land subsidence in coastal zones, a process that accelerates coastal erosion. The current research focus has been along the Gulf Coast following Hurricane Katrina specifically using airborne (UAVSAR) and satellite-based radar (InSAR) techniques to measure the extent and magnitude of land subsidence (lowering of the land-surface elevation from changes that take place underground), and assess its impact on coastal inundation and levee integrity. Another line of research and capability development is using a new approach to measure shallow coastal bathymetry (underwater topography) from space-based radar systems. This approach will make it possible to measure the changes in water depth over time in near shore environments that can be used to understand and model how near-shore wave energy facilitates coastal erosion. Finally, the future NISAR, SWOT, and Altimeter-Follow On missions will track and measure changes in the coastlines regardless of cloud coverage every 6-12 days.

Earthquake Research – NASA is proactively developing new technology, analysis techniques, and science research targeted at earthquakes and other solid earth hazards—including landslides, volcanic unrest, and land subsidence—with the objectives of better understanding geo-hazards and determining their interconnectivity. NASA's READI (Real-time Earthquake Analysis for Disasters) project utilizes real-time GNSS (Global Navigation Satellite System, including GPS) to quickly resolve the location, magnitude, and key fault parameters within minutes following a major earthquake. The fault parameters are then used to assess if the earthquake could produce a tsunami. A retrospective analysis of the 2011 Great East Japan Earthquake and Tsunami using this new approach would have provided a tsunami early warning 15-20 minutes earlier than was possible in 2011. NASA scientists have also developed a new method for tracking the propagation of a tsunami as it moves across an ocean by looking at disturbances in GNSS signal at the base of the ionosphere (the region with the aurora borealis) caused by the tsunami wave pushing up on the atmosphere. NASA is beginning to transfer the new capability to NOAA for integration into its tsunami warning centers, with initial emphasis on the Pacific Northwest. One of the NASA funded real-time GNSS centers is located at Central Washington University. NASA is also working with the Department of State and Asia-Pacific Economic Cooperation to expand this capability to the full Indo-Pacific basin. The US Geological Survey is now exploring if READI could enhance its earthquake and volcanic early warning systems.

NASA's newly established ARIA (Advance Rapid Imaging and Analysis) Center for Natural Hazards is developing a prototype end-to-end imagery and data analysis system enabling near-real time science, assessment, response, and rapid recover for natural hazards. This system integrates satellite and airborne radar and optical imagery with ground-based measurements from GNSS and seismic stations to develop a wide range of products for both the scientific and emergency response communities, including damage proxy maps that quickly assess if buildings have been damaged during a disaster. Early results from ARIA were widely used following the Napa earthquake and Hurricane Sandy. NASA's GeoGateway and Emergency Data Enhanced Cyber-Infrastructure for Disaster Evaluation and Response (E-DECIDER) projects are developing a suite of tools for hazard analysis and rapid infrastructure damage assessment following major disasters.

NISAR, the joint NASA and Indian Space Research Organisation (ISRO) Synthetic Aperture Radar satellite mission, is anticipated to launch in the 2020s and is designed to measure surface movements associated with earthquakes and other natural disasters, measure glacier motion, and assess changes in biomass. NISAR along with READI and ARIA will significantly advance the US capability to understand the fundamental physics that drive many natural hazards and provide tools and products that can be directly utilized by the disaster response agencies and policy makers.

The new technology, analysis techniques, and science research NASA is developing are uniquely positioned to better understand the natural hazards in the Olympic Peninsula. The region is directly above an active subduction zone and during a major earthquake there will be immediate threats from the earthquake and aftershock sequence, tsunami inundation, triggered landslides, and rapid coastal subsidence and increased coastal erosion. The radar wavelength of NISAR penetrates clouds and much of the dense vegetation on the peninsula and will be able to directly measure and assess changes to the land caused by the earthquake or triggered landslides. The READI system will contribute to NOAA's tsunami early warning system and may be used by the USGS for earthquake early warning. ARIA will be able to quickly assess building damage in many of the communities and directly provide maps that link surface deformation to key infrastructure.

QUESTION 4:

May you please discuss the role The Innovative Advanced Concepts Program has within NASA and your plans for the organization going forward? What is the opportunity cost of not increasing the program's budget to fund innovative research?

ANSWER 4:

The NASA Innovative Advanced Concepts (NIAC) is the most far-reaching program in NASA. Its role is to explore visionary aerospace concepts that could "change the possible" — potentially enabling exciting new missions or revolutionary leaps in mission capabilities, while maintaining technical and programmatic credibility.

NIAC funds two phases of study. Phase I is 9 months long and offers up to \$100,000 for initial investigation of the feasibility and potential benefit of new concepts. Phase II further develops the most successful Phase I concepts, for up to an additional 2 years and \$500,000. Both phases of NIAC study investigate new concepts and technologies by analyzing them in a mission context. This helps to identify risks and challenges, as well as to quantify potential benefits, both in terms of total impact and on future missions. It also helps STMD identify the highest potential impact technologies to consider for future development. NIAC calls are open to proposals by researchers from academia, industry, NASA, other agencies, and independent labs. Selections are based on peer review panel recommendations, with no predetermined allocation by type of organization or technical area.

It takes time to measure the success of NIAC concepts, as they are typically 10 or more years from implementation when first selected for NIAC study. But NIAC concepts from the past four

years have already gone on to some promising further development. To briefly list a few highlights:

- SMD awarded a \$4.5M Instrument Incubator to further develop the NIAC Atom Interferometry concept.
- HEO AES is partnering with GCD to further develop the NIAC Solid State Air Purification System concept.
- ARMD is further developing the NIAC Centrifugally Stiffened Rotor-wing concept, which strives for eternal flight.
- A partnership of NASA GCD and the Army Corps of Engineers is further developing the NIAC Contour Crafting concept, which uses additive manufacturing with local materials to 3D print whole buildings on the Moon or Mars.
- At least four NIAC studies were referenced in the 3D Printing in Space 2014 NRC report.

QUESTION 5:

Administrator Bolden, please explain if the Russians have been a beneficial partner in the International Space Station program. Do the Russians support an extension of the International Space Station operations through at least 2024?

ANSWER 5:

NASA is committed to continue ISS operations through at least 2024. Space cooperation has been a hallmark of US-Russia relations, including during the height of the Cold War, and most notably, over 14 years of continuous human presence on board the ISS. NASA has not received any official notification from the Government of Russia on any changes in our space cooperation at this point. Since the initial public declarations concerning Russia's participation on ISS, there have been multiple public indications that Russia will continue participating in the ISS program through 2024. Roscosmos has publicly commented that they expect to receive government authority later this summer to continue ISS beyond 2020.

TUESDAY, MARCH 17, 2015.

NATIONAL SCIENCE FOUNDATION

WITNESS

HON. FRANCE A. CORDOVA, DIRECTOR, NATIONAL SCIENCE FOUNDATION

Mr. CULBERSON. The subcommittee will come to order. Thank you for your service to the country and to the scientific community. We have, all of us on this committee over the years have been strong supporters of the sciences and space exploration. It is one of the great joys that I have had in Congress to get to help, serve on this committee to help the National Science Foundation and to ensure that the United States stays at the cutting edge of scientific discovery in the world. The impact that has I think on our quality of life for this generation and generations to come is self-evident. It is a real privilege for me to be here as the chairman and to work with my Ranking Member Mr. Fattah and other members of the subcommittee to do everything we can to help you achieve that mission. Recognizing of course that we are in a very difficult budget year with very tough constraints on the Congress to fulfill all that is asked of us.

We are entrusted with the task of allocating very scarce and precious, hard-earned tax dollars and it is vitally important, of course, that we be very careful to ensure that those hard-earned tax dollars are spent wisely and targeted very carefully. I can certainly think of few endeavors that are more noble or worthwhile than investing in the National Science Foundation. We do want to make sure, though, however, the money is well spent and not wasted. So I will probably spend some of my time in my questions talking about the Inspector General's report. I know you are still fairly new on the job. But I do have a lot of concerns about some of the things that the Inspector General pointed out and I want to go over some of those with you.

Your request for this year, for 2016 is \$7.7 billion, about a five percent increase of \$379 million over the current fiscal year. And I know that my colleague Mr. Fattah and other members of the subcommittee feel as I do, that we certainly want to make sure that we help you. But again, it is really going to be a difficult, a difficult budget year.

I am delighted to have you here, look forward to your testimony, and am happy to recognize my good friend Mr. Fattah for any opening statement he would like to make.

Mr. FATTAH. Well first of all let me thank the chairman for hosting this hearing. I think it is very, very important that the premier basic science and research entity in the world, we have an appropriate understanding of your budget and we can do that

through this hearing. The work that is being done is critically important. And I want to put in some, and if you would as you talk today, in context what our friends around the world are doing. Right? So I was with Judith Rodin at the Rockefeller Foundation and she was saying that in China they just opened up 100 science only universities, and 200 math and science focused institutions. They have invested a great deal in basic scientific research. Now that is a big and plus populated country. But Singapore, which is a much smaller country, less people there than in the Philadelphia region, their National Science Foundation, which was built off of, you were the benchmark for it, they have invested over \$7 billion. And this is a small, small, I mean, you know how big Texas is, right? I mean, 4.5 million people in Singapore. I mean, the fact that they could make such a huge investment.

And then our friends in the European Union with Horizon 2020, which is a seven-year effort, well over \$80 billion euros, focused just in six areas. You know, marine science, neuroscience, which of course is my favorite, but agricultural science. So I am wondering when we think about America and we think about our leadership in the world, which was at one point absolute and now is relative. That is, that we still lead but there are people who are chomping at the bit and they want a piece of the action. In fact, Singapore has been hiring away some of our best scientists. So the head of the National Cancer Center, and his spouse, and on, and on, and on. I mean, they have been picking up pieces because they intend to be indispensable in the world. So I am wondering when you talk to us today about the work of the Science Foundation you could put it in context so that it is not just a matter, I do not see it as just a budget for an agency. I really see it as the indispensable lynchpin to this innovation ecosystem in our country. That if we do not invest in basic science research, none of the other things that we want to do as a country are going to be possible, including our national defense which is so very important. A lot of the breakthroughs in our ability to defend ourselves against the world's threats start at their core from work at the, that has been funded by the National Science Foundation.

So welcome, I thank the chairman, and look forward to your testimony.

Mr. CULBERSON. Thank you very much. I certainly share Mr. Fattah's feelings. And I hope as a part of your testimony today you will talk to us about the other nations in the world and their investment. I think Mr. Fattah is exactly right, to focus our attention on that. Where are other nations in their investment in the sciences? In the pure sciences and engineering and where we are in relation to them.

Of course your statement will be entered into the record in its entirety, without objection. And we welcome your testimony. And we want to encourage you, if you could, to keep it within about five minutes as a summary. So thank you very much and we look forward to hearing from you today. Thank you, ma'am.

Dr. CORDOVA. Thank you, Chairman Culberson, Ranking Member Fattah, and members of the subcommittee. I see Congressman Jenkins, good to see you again. I am pleased to testify today on be-

half of the National Science Foundation's fiscal year 2016 budget submission.

In my written testimony I have addressed specific aspects of our budget request, including funding for our four cross-directorate programs, "Understanding the Brain," "Risk and Preparedness for Disasters," "The Interrelatedness of Food, Water, and Energy Science," and "Expanding Efforts to Broaden Participation in STEM." NSF believes that this budget comprises a strong request that is responsive to the national interest in science as well as science in the national interest.

In this, my oral testimony, I will address three more general questions. First, why do we fund what we fund? Namely, all fields of science and engineering, including the sociobehavioral and economic sciences. Secondly, how does our agency set priorities for funding? And third, what is NSF's long range plan, our vision for science? And Ranking Member Fattah, I will try to answer in one sentence your question about international and then perhaps we can follow that up in the rest of the testimony.

On the first question, why do we fund what we fund? Let me quote President Harry Truman, "I have just signed the National Science Foundation Act of 1950. This Act is of tremendous importance because it will add to our knowledge in every branch of science. I am confident that it will help to develop the best scientific brains in the nation. It will enable the United States to maintain its leadership in scientific matters and to exert a more vital force for peace." So he was addressing just what you were talking about, Congressman.

NSF has long prided itself on adding to the knowledge base for all science and engineering. That is by statute not a narrow focus. Many of our important challenges require the perspectives and knowledge of both physical scientists and social and behavioral scientists. It is interesting to note that the last 51 Nobel Prize Winners in Economics have been supported by our Social, Behavioral and Economics Directorate. We believe that good research, often interdisciplinary in character, can inform us in the face of big scientific questions.

On the second question of setting priorities, we start with input from the large community of scholars, scientists, engineers, and educators. This can come in the form of decadal surveys, which set priorities for a discipline. NSF sets its priorities in part through these surveys. Examples include the Decadal Survey in Astronomy, and the recent Ocean Science Decadal Survey. We also support studies by the National Academies and carefully weigh the advice of scientific societies, NSF sponsored workshops, and universities and research centers. We balance all this external input with the input of our talented staff at NSF and then carefully put our budgets together.

Lastly on the third question, what is the ten-year plan for the National Science Foundation? I am reminded of a question posed to Condoleezza Rice, long before she became Secretary of State. She was asked what her strategic plan was for her future. She said that if she had made a strategic plan when she was young she would have been playing the piano at Nordstrom's. She was a gifted child pianist. The point is that some people, and for some agen-

cies like the National Science Foundation which pursues the most fundamental research, planning needs to be highly flexible and adaptive to discoveries, insights, and advances that are unpredictable. It is limiting to plan for a future that cannot be envisioned. It is the opposite of what we were funded to do, which is to pursue great ideas of creative people.

I am an astrophysicist. When I was in graduate school, there were no known planets orbiting other suns. There was no detection of the Higgs boson. We had not discovered yet dark energy, which we now know to comprise 75 percent of the matter energy content of the universe. How could we not have known? Because the basic science had not yet been done, and we could not have predicted where it would lead us. Can we make a ten-year plan for where our research in these wondrous new areas will lead us? We can, and do, plan very carefully in as much detail as our current knowledge permits.

Our plan, which we update every four years, has been approved by the National Science Board. Additional details are filled in by those scientists and engineers who pursue fundamental research, wherever it leads. And exciting, new, and unexpected directions can be pursued precisely because of our flexibility.

And now let me just take—is the red light on there? Does that say five? Just one second to open the door to discussing international collaborations. As the recent report from the American Academy of Arts and Sciences said, and they addressed this in “Restoring the Foundation,” that the U.S.’ place has slipped to number ten in the world as far as the expenditure of R&D divided by GDP. And we used to be number one or two a decade or so ago. So there is a lot of good hard evidence for our concern, in spite of the fact that we do spend substantial monies in R&D, as you point out Congressman Fattah: the rest of the world is relatively spending more, their first derivative is just simply higher than ours. And they are bringing back students and professors that we have had at our universities and giving them good packages there.

And everywhere we go around the world, and especially in Asia, we see the growth of universities and the growth of the investment. Just yesterday I was with the Prime Minister of Ireland, where we were celebrating St. Patrick’s Day. And he was pointing out, as was his Minister of Science who leads their equivalent of the National Science Foundation, the substantial investment that Ireland has been making and that they have an enormous innovation product as a result of that and they are very, very proud of that. Much credit was given to the National Science Foundation for originally providing the model for that investment. So I look forward to your further questions in this and all areas. Thank you, Mr. Chairman, for the opportunity to address you.

INSPECTOR GENERAL REPORTS ON FACILITY CONSTRUCTION FUNDING

Mr. CULBERSON. Thank you very much, Dr. Cordova. And I want, if I could, to talk about the Inspector General’s report from last September in particular. Because we are all of us in the subcommittee enthusiastic and very supportive of the work that you do, and the awarding of grants, and the work that you do in ensuring that the United States maintains its leadership role in the

world in scientific research. Particularly in the pure sciences, which obviously include the earth sciences as well. But the budget environment in which we operate is so constrained that I am compelled to in the weeks ahead, follow up with a visit out to headquarters to talk to you about this. I am so concerned about what the Inspector General tells us about some of the deficiencies and the ability of the National Science Foundation to independently verify the cost of, for example the Daniel Inouye Solar Telescope, the Large Synoptic Survey Telescope.

The Inspector General points out that after over four years of attempting to audit the proposed cost for construction of the telescopes there continues to be a lack of adequate documentation to determine if the costs are fair and reasonable. And the Inspector General also points out that the NSF's internal review, for example of the cost of the Large Synoptic Survey Telescope, it was not possible for you all to independently verify costs for any of the 136 proposal expenditures sampled, including approximately \$145 million in direct materials. And after this critical report was issued the Inspector General points out the independent proposal and accounting system audits were clearly warranted to ensure the adequacy and proper accounting of the proposed costs, but instead of obtaining those audits NSF had a contractor perform a sufficiency review which is a less rigorous assessment than an audit. And in September, 2014 the Inspector General issued an alert memo expressing strong concern that NSF did not have sufficient information to establish a reasonable basis for the cost of the LSST project. They have been urging NSF for the last four years to strengthen accountability of your high dollar, high risk cooperative agreements for large construction, large facility construction projects. They point out, quite correctly, that you do indeed apply your highest level of attention and scrutiny to determine the scientific merits of the projects that you attempt to fund. But it is this independent assessment of the actual cost, to be able to verify that and strong audit procedures that the Inspector General has recommended apparently repeatedly. I understand you are still fairly new on the job but I would like to, in light of the difficult budget environment in which we operate, in light of this committee's strong support for the work that you do and our passion to help you do what you do, to assure our constituents that their money is being wisely spent, what have you done to comply with the Inspector General's recommendations?

Dr. CORDOVA. I appreciate the question. And even though as you said I am relatively new, I have been on this from the first moment I stepped in the door, I can assure you. And from my previous positions heading up a couple of our nation's great universities, I take the responsibility of excellence in management as seriously as I do our mission to further the progress of science.

I will just say a couple of general things and then address your specific questions. The Foundation is committed to working closely with the Inspector General and her office. I meet regularly with the Inspector General and we go over all the issues that are outstanding. I truly do believe, as you do, that it is only with the strong support of the Inspector General and Congress that over-

sight of taxpayers' resources can ultimately be achieved. And we are very appreciative of those efforts.

I will also say in a general sense, and I will be happy to send the particulars, that many of the Inspector General's, in fact I would say most of their observations and recommendations we have followed. We have saved the taxpayer monies in our travel costs in the last couple of years, the way we are doing virtual panels. We have saved in a number of other areas and I can detail them.

Dr. CORDOVA. Now on your specific issues. Sometimes as you know there is I.G. information that is given to Congress, and that information perhaps is not reviewed for a period after that even though NSF has responded to all the actions. So I will say, again in a general context, that it is important that we know exactly what you know from the I.G., when you know it, so that we can respond to you in a timely manner that yes, just two months ago we did such and such in response, or yesterday. In the case of one recent memo we did, we have issued our response, or we are going to in a couple of weeks. So there is kind of a timing issue here because we have been on all of the issues you have described and we have responded to each in turn.

For example, with respect to the Large Synoptic Survey Telescope, NSF did apply a formal response to the alert memo on January 23rd of this year. With respect to two significant deficiencies, prior year's significant deficiency related to NSF's monitoring of construction type agreements, and NSF's practices, I can assure you we properly follow the OMB's newly clarified guidance pertaining to contingency funding and awards. This notwithstanding, NSF is going to continue to strengthen our controls for awarding and managing construction type cooperative agreements, exercise an enhanced surveillance in response to OIG concerns, and perhaps most importantly, we have with the great help and blessing of the National Science Board, represented today by its Chairman Dr. Dan Arvizu, who is sitting behind me. We have co-asked an external entity to provide us with a very thorough investigation, I would say "study", of our cooperative management vehicle. And we hope within a few months time to get the first phase of the study done. But it is a careful statement of work that addresses all of these concerns and really looks at the details. And we think that by putting it out in a very well recognized external entity they can address it properly.

IMPLEMENTING INSPECTOR GENERAL RECOMMENDATIONS

Mr. CULBERSON. How about implementing the Inspector General's specific recommendations that you strengthen the accountability of your high dollar, high risk cooperative agreements and have essentially an independent proposal and accounting system audit in place? Have you begun to implement their recommendations that they have been recommending now for the last four years when it comes to your high dollar, high risk cooperative agreements for large construction projects?

Dr. CORDOVA. Yes, we are. And I would be able to follow it up with more detail. But we have it in our policy manual for our large facilities. That office has a new leader and we have really strength-

ened the policies and procedures in that manual, Mr. Chairman. We are moving in that direction. Now that is not to say we do not have areas where we disagree with the IG's office about following exact guidance of the OMB. And that is why we are asking an external entity to study this. But we have really tightened up our procedures and policies. And very recently we gave 292 documents to demonstrate this to the Senate in response to their questions on these issues.

Mr. CULBERSON. Okay, thanks. I will follow up on this with you. And I would love to come out and visit the headquarters and I want to learn more about what is going on with the moving of the headquarters. I want to recognize my good friend Mr. Fattah, thank you.

Mr. FATTAH. Thank you. I am in agreement with the chairman on almost everything but when he said that he was concerned about the telescope and he was going to come over to headquarters, he really lost me there. I thought he was saying that we would go to Hawaii and look at the telescope. So, see, so you know, maybe as he follows up, you know, there will be an opportunity for the subcommittee and we can go inspect this.

But no, on a serious note, you know, I want to get to my point in a minute. But obviously we have a department in the federal government that has not been able to be audited. It is the largest recipient of discretionary money, the Department of Defense. It has never been able to sustain an audit. We have a bill I think now where we are saying they have to be audit ready by 2025. But today's budget that will be released will put another \$90 billion into Defense. So it is, yes, Mr. Chairman?

Mr. CULBERSON. I want to be sure to point out that the United States Marine Corps—

Mr. FATTAH. Yes, absolutely.

Mr. CULBERSON [continuing]. Was the first to accept generally accepted accounting procedures.

Mr. FATTAH. Yes.

Mr. CULBERSON. So they can be audited independently, and then the Navy followed suit. So the Marines are once again first on the beach.

UNDERSTANDING THE BRAIN

Mr. FATTAH. So they, in our lifetime we may get to a point where the \$600 billion or so we spend in Defense will be auditable in any reasonable way. They lost \$9 billion that they cannot account for in Afghanistan. Now in, it is gone. Right. So, I just want to make it clear, right? That these issues are important but everything is relative within the context of the world that we live in. And I appreciate the fact that we have IGs. I, with Chris Shays, was one of the early cosponsors of the bill that created the IG Act. But I think it is very important that they focus, that we need to make the main thing the main thing. Right? So and not get too, that sometimes I think some of their work is not as helpful to focusing on what is the driving impulse here, right? So I want to focus on what I think, and I think everybody in this room knows, that I believe is the main thing which is understanding the human brain. And the chairman is going to, we are going to have a hearing next

week. But I see you list this as one of the cross-foundation investments. And I want to make a point.

I was out at a university and saw a young lady who is 51, she has lost complete control of any part of her body. But she was able to move an artificial arm, give me a high five, give me a fist pump, using her thoughts. And this is out of some National Science Foundation research. Thirty years ago there was a scientist, who was the same one I met 30 years later. He got a grant from you because he said he wanted to see what happened in the brains of a chimpanzee when the chimp moved his arm. You know, what neurons fired off? And anyway, this research has been funded, and funded, and funded. And now it has interceded in the lives of people who are suffering from debilitating diseases, where their brains are completely there but their ability to control their body is not. So I want to say that the work of the Foundation is very important. And I want to, the point that I wanted to ask you about is it says in the, this "Understanding the Human Brain" that the administration's brain research, that sentence right there. Because the members of this committee, we think that the administration's brain research effort is really, has a paternity that is shared in with the Congress. That we created some language in 2011, I sent a member of the staff of this committee, Darek Newby, over to the National Science Foundation. He met unit by unit with the directorate around what was being done about the human brain. Out of that we passed some bipartisan language that created this brain initiative. And I just want, when the administration comes over, and I love the administration, is to make sure that they are aware that this is a, this is an effort that is joined in with the Congress. This is not something that the administration just decided to go do.

And it is important because this administration, in 20 months or so we will have a new administration. So it is important that you understand and the Foundation understands that the Congress, Chairman Rogers has been very interested in addiction issues. And the chairman and I, we have met numerous times on this issue. That is one of the reasons why we are holding a hearing on this. So I just want to make the point that this is not an executive branch activity solely. This is an activity that the United States Congress and the administration share in, understanding how important this is. So if you would like to respond, please.

Dr. CORDOVA. Thank you. Yes, the administration's brain initiative that focuses on developing new neurotechnologies is part of, but only a part of, NSF's efforts going forward, and just a part of our Understanding the Brain cross-directorate initiative, which includes cognitive science and neuroscience, and always has. We have always funded brain research at the NSF at the basic level.

This time we are hoping with the new expanded initiative to involve engineering. I have the Head of Engineering here, Pramod Khargonekar, with me, and they are interested in a more systems approach to Understanding the Brain. And also physicists, and chemists, and getting more people involved, because we think that new discoveries will come from that.

Mr. FATTAH. I just want the record to be clear. So we have created language in the report that required the creation of the inter-agency working group.

Dr. CORDOVA. Right.

Mr. FATTAH. It was co-chaired by NSF and NIH.

Dr. CORDOVA. Mm-hmm.

Mr. FATTAH. And that the brain initiative is an outgrowth thereof. So that I just think it as important so we can be as supportive as we want to be, that you include an understanding that the Congress shares totally in this effort.

Dr. CORDOVA. Thank you.

Mr. FATTAH. Thank you, Mr. Chairman.

Mr. CULBERSON. Thank you. Mr. Jenkins.

GREEN BANK TELESCOPE

Mr. JENKINS. Thank you, Mr. Chairman. I was taking a quick look. The temperature in Honolulu is 64 degrees right now. At Green Bank, West Virginia, where there is another telescope, we are going to get up to 64. So it is not driven by the weather that you are wanting to go to Hawaii. And I am excited to know of your interest in visiting a telescope, because we proudly have the Green Bank Telescope in my district. And it is only four and a half hours away, so we will be happy to do a field visit.

Good morning, and welcome. I am glad to have you. And for the members of the subcommittee I had the honor of having dinner with the EPSCoR folks and having an opportunity to sit with and talk with the Director at that time. So thank you very much.

I would like to delve in a little bit. I visited Green Bank yesterday and had the opportunity to speak with the Director there, Director Dr. Karen O'Neil. Give me if you would not mind, Madam Director, the current NSF funding vis a vis that project? Obviously I am most interested in the Astronomy Portfolio Review Committee's recommendation from two years ago and where this project sits vis a vis this particular budget.

Dr. CORDOVA. Mm-hmm. So Congressman Jenkins, we do, as I said in my opening remarks, really listen to decadal surveys. And there is an astronomy, the most recent decadal survey, and then followed up by as you pointed out the Astronomy Portfolio Review, in which they, within the context of a projected budget, set priorities. And because our budget is limited, we, in an effort to do new things and expand our horizons, also need to look with an eye to divest things that have been going on for a long time and afford us, with a careful divestment, of the opportunity of doing new things with limited dollars. And so the Astronomy Portfolio Review did identify Green Bank, among several other telescopes as you know, as being one to be divested. But the astronomy group does not do that lightly. So we have had an ongoing study, and we should have a report by the middle of this calendar year, on what the environmental landscape looks like, what potential partners could be. And we would like to proceed in a very careful orderly fashion.

I personally have talked with the President of West Virginia University about this and his deep passion for this telescope, and also previously with Senator Rockefeller, of course, who shared that passion. And we are, we are committed to doing the right thing. And a lot of these telescopes, of course, once they have been operating a long time are great for raising new students and giving

them an awareness of the universe and an opportunity. And so we are looking at outreach opportunities, we are looking at training opportunities. And we will let you know just as soon as that study is done of what divestment options are possible.

Mr. JENKINS. Is there a basic philosophy? What I am hearing you say, and there is no direct correlation I assume between the budget request as the chair indicated, the proposed budget is actually higher than what you are currently funded at, is that correct?

Dr. CORDOVA. That is right.

Mr. JENKINS. So while you are seeking more money, what you are saying philosophically is that through this process you go in and evaluate projects and through this review structure you then may divest yourself. So out with the old, in with the new? Is this a process you go through? So regardless of where we stand budgetarily, there is no direct correlation necessarily between the funding you receive and the projects you are going to fund over the course of the year?

ASTRONOMY FACILITY PRIORITIES

Dr. CORDOVA. Well Congressman, there is a great indirect correlation. Because if we were, I mean, astronomy is a very expensive field. And these telescopes we were talking about earlier, LSST and DKIST among them, are big costly facilities which are deemed appropriate by the scientists and really the whole astronomy world comes together in this priority setting exercise. And so the budget, as you pointed out the budget request is 5.2 percent higher. That is not enough. It is over all fields of science and engineering, as you know. So there are budget numbers that are given, both constant and just a little bit of increase, to these review committees when they get together. And it is in that context that they make these decisions.

Mr. JENKINS. What is your power and authority in the funding mechanism? You know, after Congress, you know, passes a budget, or through whatever mechanisms you are funded, it seems to me the ball is then in your court and you are in the, theoretically the bully pulpit. You are the holder of the purse strings. People come to you through their application process. You are the decider. What leverage, because I think you would have a significant amount of leverage. Because I know Green Bank, for example, works with NASA, they work with EPSCoR, they work with the STEM emphasis in education, higher ed institutions like WVU. I politely want to challenge the NSF to take what I believe is an asset like Green Bank Telescope, the only fully directional telescope in the world, and all of those players around, and challenge them to step up to the plate and engage in a collaborative way. Because I would think you would want one plus one to equal three. Let us figure out how to use your dollars, taxpayer dollars that are appropriated through this process, to their maximum extent possible. Could I challenge you to get the NASA folks, and the higher ed institutions, and others to try to work collaboratively? And as you, through this process, these coming months, let us see if we cannot take a critically important asset and make it as useful as possible so the next time we have a review committee they say we cannot afford to lose this.

Dr. CORDOVA. Right. Well, I accept your challenge, Congressman Jenkins, and look forward to working with you.

Mr. JENKINS. Thank you, Madam Director. Thank you, Mr. Chairman.

Mr. CULBERSON. I know that Mr. Serrano would feel the same way about the Arecibo Telescope as well. And it is vitally important that we protect these assets, and at the very least that we are working to make sure that if indeed, they are shut down that we have replaced them. But it is a vitally important facility—

Mr. JENKINS. Thank you, Mr. Chairman.

Mr. CULBERSON [continuing]. At Green Bank as well as Arecibo.

Dr. CORDOVA. Yes. And I have talked as early as just one week ago with Administrator Bolden about the Arecibo Telescope. As you know, he has visited it recently. And so NASA is one of the potential partners. And divesting does not mean that it will not continue, it simply means that our share in it will be different at the end of it. And that is, that is not an unwelcome outcome if we have good partners and it can be sustained to do good science.

Mr. CULBERSON. And my concern is the same as Mr. Jenkins, and I know everyone on the committee, when I ask about the Inspector General and the independent cost verification and the audits. It is because it is so important to protect your sterling reputation, and we do everything we can to make sure that the public understands that you are spending their hard earned money wisely and carefully and that you have done everything you can to ensure that, as Mr. Fattah said, it would certainly help with the Pentagon, you have got the ability to have independent outside cost verification and audits. So let me at this time recognize Mr. Kilmer.

SCIENTIFIC COLLABORATION BETWEEN THE U.S. AND ISRAEL

Mr. KILMER. Thank you, Mr. Chairman. And thanks for being with us. Last year Congress established a national policy under the U.S.-Israel Strategic Partnership Act to pursue opportunities to deepen the relationship between the U.S. and Israel. And I understand the NSF is currently pursuing some collaborative research between researchers and engineers in our two countries. I am supportive of that and I would like to see that level of activity expanded. Does the NSF plan to continue supporting collaborative research between, within academic research between the U.S. and Israel and plan on expanding the breadth and depth of support for additional research between our two nations?

Dr. CORDOVA. Good morning, Congressman Kilmer.

Mr. KILMER. Thanks.

Dr. CORDOVA. NSF does support significant collaborations between U.S. and Israeli researchers as you pointed out. In fact, I went through the tables and counted 57 such collaborations. These are typically as you know bottom up or researcher driven. However, in some areas there are specific opportunities that encourage U.S.-Israeli collaborations and these are built upon clusters of excellence that exist in both the U.S. and Israel.

I have made three trips to Israel myself, in fact I have an honorary degree from Ben-Gurion University of the Negev. And I have seen the great technology prowess of many, many universities in

areas where mutual collaboration is definitely warranted. So we look forward to, we do not set aside, as you know, particular money to collaborate with particular countries in general. But we are increasingly collaborating with international partners at the forefront of science.

And let me add something of interest also in response to your question, and to Ranking Member Fattah's question. Today we are putting out a public press release that announces the new head of our International Science and Engineering Office. And this is an office which you approved in our spending plan that to give it the proper attention I would separate it out as directly reporting to me, and now we have a new Head. And I think you will be pleased. I do not know if the notice has come out now, or in an hour from now, but I think you will be pleased to see who is going to be leading that and her background.

SUPPORT FOR ARCTIC RESEARCH

Mr. KILMER. I want to go to a different part of the world. As the Arctic is becoming more and more navigable its importance to our national security also rises in importance. You know, I understand that NSF is making some investments to study the Arctic, such as Sikuliaq, the Arctic Observing Network. What are the NSF's plans for enhancing funding to the Geosciences Directorate to utilize that infrastructure investment and how does NSF plan to respond to the need for enhanced arctic research and effective infrastructure utilization within Geo?

Dr. CORDOVA. The NSF recognizes of course the importance of arctic research and I am the Chair of a subcommittee of the National Science and Technology Council, which is an interagency committee devoted to research in the arctic. We spend at NSF about \$150 million per year on arctic research, with about \$100 million by the arctic section of Polar Programs and the remainder distributed throughout other programs in the agency.

OCEAN OBSERVATIONS INITIATIVE UPDATE

Mr. KILMER. One final question. Can you give me an update on the status of how the cables and sensors of the Ocean Observation Initiative are operating, and what the long term operation and maintenance plans are for the Ocean Observing Initiative within the NSF?

Dr. CORDOVA. My understanding is that the cables are working very well, especially in the Pacific Northwest region. And they are a model for the investment. I personally am very much looking forward to our OOI getting fully implemented, which as you know will be very soon.

Mr. KILMER. Thank you. Thank you, Mr. Chairman. I yield back.

Mr. CULBERSON. Thank you very much. Mr. Jolly?

THE ROLE OF COMMUNITY COLLEGES IN STEM EDUCATION

Mr. JOLLY. Thank you, Mr. Chairman. Thank you for being here. I do not think I have ever had the opportunity to have a conversation with an astrophysicist, so thank you for being here.

I had an opportunity to visit with your team earlier this year on the broadening contribution of community colleges when it comes to STEM. And I would like to talk to you just briefly, get your thoughts, your vision, in terms of the Foundation's mission when it comes to STEM, and the evolution of community colleges from the fifties, when you know the original mission of NSF was stood up. The community colleges today have become a first choice institution for many students. The offerings, the portfolio are now four-year degrees, many of them focusing on STEM, many of them competitive with research universities in terms of the education in the sciences, the ability to contribute to the work force of the sciences, of engineering. And you know, clearly they are not research universities, I recognize that. But how has the mission evolved at NSF to begin to recognize and include contributions from community colleges? Particularly in the broader mission of having a population and a work force that is trained in the sciences, but perhaps in a way that does not reach the level of basic research, extensive basic research I should say, but still contributes to how our national STEM needs as well as our work force STEM needs, where is NSF in that process? And what is your vision of it coming from a research university background?

Dr. CORDOVA. Thank you, Congressman Jolly. Yes, I also have a background in a system, the University of California system that you might know has many, many community colleges. And I spent a lot of my time as Vice Chancellor at U.C. Santa Barbara and then Chancellor of the U.C. Riverside campuses being concerned with students migrating from community colleges to the University of California and the Cal State campuses.

I was also very much struck by a report that the California Council on Science and Technology did which showed that fully half of the science and engineers baccalaureates in the University of California system had their start at the community colleges. So that is a huge impetus. So that is one thing.

Another is in our Broadening Participation initiative, and as you know we have a big cross-directorate initiative for fiscal year 2016 called INCLUDES, and one of its purposes, its main purpose, is to broaden participation. As Congressman Fattah said, many of the international folks are being called back home. We have to further develop our own STEM national workforce. And the community colleges are a great place for this. They also represent, as you know from Florida, a significant change in the demography and we want to capture the hearts and minds. And from an astrophysicist, there is nothing like talking about the universe to do that for our students.

So how have we actualized that? We do have programs. And I have with me our Head of Education and Human Resources' Joan Ferrini-Mundy, who can describe more in follow up information on specific programs from community colleges. I know of a recent one since I have come on board, which is two dear colleague letters to these universities, especially the Hispanic-serving ones, to have them make proposals to fund more research experiences for undergraduate students at the community colleges. There is nothing like an undergraduate research experience. And I had such an experience and it changed my life.

Mr. JOLLY. Sure.

Dr. CORDOVA. And Dr. Varmus at the National Cancer institute will tell you the same thing, that we both changed from being English majors to becoming scientists because of our research experience.

Mr. JOLLY. And now you are here. I do not know if you have done something right or wrong—

Dr. CORDOVA. Oh, I am here.

Mr. JOLLY [continuing]. And we had a great visit with Ms. Mundy, and I want to compliment your leadership team. And we have talked about this. And the reason I bring it up on the record is really, I represent a community that does have major research universities nearby but the fact is it is a community where because of the cost of higher education these days, and because of the quality of four-year degrees now offered at what traditionally had been two-year colleges in the fifties and sixties when NSF was first founded, it is a different landscape in higher education now and it is an opportunity to capture a very different student base that perhaps we had not had the opportunity before. I think it is a great opportunity for NSF and for us as a country.

Dr. CORDOVA. Yes. And I completely agree with that. I have been informed that we are investing \$66 million in Advanced Technology Education for community colleges—

Mr. JOLLY. Sure.

Dr. CORDOVA [continuing]. In addition.

THE BRAIN INITIATIVE

Mr. JOLLY. Thank you. And if I, is my time up? Do I have another—I just wanted very briefly on the brain initiative, and I concur with Mr. Fattah's comments. What is your assessment of where we are? What is the maturation in terms of current resources, results to be expected? I mean, is this an area that we are expecting breakthroughs? And if so, are the current resources sufficient? Is it an area for dramatic discoveries if we were to increase that investment?

Dr. CORDOVA. I think it is absolutely the area for the most dramatic advances. You know, it is interesting that we spend a lot to explore the first moments of our universe. We spend a lot to explore the nature of matter and particle accelerators. And the most complex organ that we know of in the universe is ourselves, our brains. And we know the least about that. There is a huge horizon for understanding it better. And I compare it to the days, my early days, when astronomy changed to astrophysics. The astronomers of yore collected photographic plates of the heavens and they made a lot of advances. In my own field, which is high energy astrophysics, so you have to get above the atmosphere, the real advances came when the physicists and engineers stepped into the picture. And they said we can launch rockets and satellites and new kinds of detectors, new sensors that we are developing through our young brains. And they made incredible advances. The field I ended up in, x-ray astronomy: we did not know there were x-rays given off by other astrophysical sources. And we do now because of technology. And so it is technology, I think in part, that will give us a better understanding. And that is why the emphasis on

neurotechnologies, on how to image the brain in real time. And in addition through our social and behavioral sciences we will understand more about how people react and understand more about the behavior of the brain. But both are necessary. We need the technologies in order to really investigate the brain.

Mr. JOLLY. Thank you very much. Mr. Chairman, thank you. I yield back my second round.

Mr. CULBERSON. Thank you. Mr. Honda.

Mr. HONDA. Thank you, Mr. Chairman. And welcome, Dr. Cordova. Thank you for joining us today. I would like to commend you for your efforts to advance America's scientific leadership. And for decades the U.S. has been seen as a beacon for encouraging free thought, which you were just talking about, and supporting fundamental scientific research. Students and innovators from around the world have flocked to the U.S. to study and do research. And the research they perform not only pushes the bounds of our understanding of the universe but also directly fosters U.S. prosperity and global leadership and awards for the social sciences.

Much of this fundamental research, scientific discovery, and promotion of STEM education supporting tech innovation is supported directly by the NSF and the programs your agency supports play a major role in keeping the U.S. on the cutting edge of science and engineering and truly makes the U.S. the innovation capital of the world. And so I look forward to working with my colleagues on this committee to make sure that NSF has adequate resources to continue to support scientific research, from anthropology to zoology, through scientific advances that will push the bounds of human understanding and inspire future generations of innovators and power the present and future U.S. economy.

Having said that, one of my staffers is an astrophysicist from the University of Santa Cruz. So he was very excited about your background.

Dr. CORDOVA. Wonderful. I have a t-shirt with Santa Cruz and my own field on it, cataclysmic variable star with U.C. Santa Cruz on it.

Mr. HONDA. With that——

Dr. CORDOVA. I just want to connect.

HIGH PERFORMANCE COMPUTING

Mr. HONDA [continuing]. Reclaiming my time, in the area of high performance computing, I commend NSF for its important and historic role in advancing our nation's competitiveness through the support of a vast computing infrastructure and the science and engineering applications it enables because that is critical. The NSF should plan and commit its vision for maintaining and modernizing this world class big data and high performance computing that supports all areas of scientific research and education, including the most demanding and challenging science problems. And in view of the NSF's considerable expertise in high performance computing for open science, what is NSF's plan to maintain and modernize its high performance computing infrastructure, software, and applications?

Dr. CORDOVA. We have, as you know, a whole division that is focused on computing infrastructure information for science and en-

gineering. And we have a lot of assets around the United States in high performance computing. In previous testimony I have talked about results from the Blue Waters computer, and from the Texas Stampede computers. But those are only two of the many facilities that we have. So I would be very happy, Congressman Honda, to provide you with backup materials that describe all of those assets and exactly what the plan is for advanced computing infrastructure going forward.

[The information follows:]

As directed in both House and Senate reports to the FY 2015 Commerce, Justice, Science, and Related Agencies appropriations bill, and adopted in the related conference report, NSF will provide a report to Congress on High Performance Computing by April 15, 2015. (Excerpt from House and Senate reports are below). This response from the Foundation will also respond to the question from Representative Honda on *NSF's plan to maintain and modernize its high performance computing infrastructure, software and applications*.

Here is the relevant excerpt from House Report 113-448 to the Commerce, Justice, Science, and Related Agencies Appropriations Bill, 2015: "*High performance computing*.—NSF shall provide to the Committee the agency's plan for maintaining and modernizing its big data and high performance computing infrastructure, including related software and applications, to support all areas of scientific research and education. This plan, which should be provided not later than 120 after the enactment of this Act, shall include a focus area on transitioning relevant research to operations."

Here is the relevant excerpt from Senate Report 113-181 to the Departments of Commerce, Justice, Science, and Related Agencies Appropriations Bill, 2015: "*High Performance Computing*.—The Committee requests a plan from NSF on how the agency plans to maintain and modernize its high performance computing infrastructure, software, and applications that support all areas of its scientific research and education. The plan should also include how the agency plans to transition research using high performance computers to operations that will requires similar computing capacity. The plan should include NSF's estimate of cost of any modernization efforts as well as any costs associated with maintaining these systems."

IMPORTANCE OF FUNDING A WIDE VARIETY OF SCIENTIFIC DISCIPLINES

Mr. HONDA. Thank you. In the last Congress we saw an unprecedented expansion of congressional interaction with NSF's scientific grant award process. And the NSF was required to share a large number of documents and correspondence relating to projects that were funded by the Foundation. The intended goal of gaining access to the information seemed to be to demonstrate how some research programs, particular those in the social and behavioral sciences, were not in the "national interest," and that it was wasteful and irresponsible of NSF to fund them. This targeting and the mischaracterization of social and behavioral science through a 15-second inflammatory sound byte rather than being thoughtful discussions and in an informed debate, was very troubling to me. And the funding and publishing of scientific research needs to remain in the hands of scientists and the peer review process and not subject to a lot of the political pressures that we impose. Could you speak, and you mentioned earlier, speak briefly to this point, and perhaps give some examples to highlight the important of funding a wide variety of sciences, including social and behavioral sciences? And how is the funding of social science in America's national interest, since you mentioned briefly about neuroscience also? So I would be very interested in hearing your response to that.

Dr. CORDOVA. Right. Well, thank you. Well, clearly we believe that the social and behavioral and economic sciences is a vital part of our whole portfolio. In fact, so vital that if one looks in detail at our cross-directorate initiatives for fiscal year 2016, one can see that the social and behavioral sciences are very much involved in all of those.

The social and behavioral and economic sciences study with scientific tools the behavior of institutions and individuals and response to change. SBE is NSF's smallest research directorate, representing less than five percent—

Mr. HONDA. Mm-hmm.

Dr. CORDOVA [continuing]. Of the total of NSF's research and related activities account, and around three percent of its total portfolio. The impact of the social and behavioral sciences has been enormous. You asked for a couple of examples. I will just give you a very few. We contributed mightily in the social sciences to the FCC's notion of spectrum auctions, which have netted over \$60 billion in revenue for the federal government. That is the apportioning of the airwaves via a practical application of game theory and experimental economics. Almost 20,000 kidney transplants take place in the U.S. each year and the waiting list continues to grow. A Nobel Prize Winner funded by NSF led a team of researchers that developed a computational technique that greatly expanded the pool of safe exchanges in the chain of cooperating pairs of donors and recipients. A third example would be in SBE-funded research that studied nonverbal communication cues that has been picked up by the Army, specifically the Army Research Institute, which now incorporates nonverbal communication education into soldier training. And you can imagine where that would be very important. And then in the mid-1980s that directorate, SBE, made a commitment to fund the National Center for Geographic Informa-

tion and Analysis at three universities. I had the opportunity to visit one of those and see close hand——

Mr. HONDA. Mm-hmm.

Dr. CORDOVA [continuing]. The tremendous things they are doing. And it has really changed the whole development of the multibillion dollar geographic information industry. So those are just a few select examples.

Mr. HONDA. Thank you very much. Thank you, Mr. Chairman.

SAFEGUARDING THE TAXPAYERS INVESTMENT

Mr. CULBERSON. Thank you. I completely agree that the work that you do and the grants that you award, the scientific research that is conducted by universities and researchers across the country, should be driven by the facts and the sciences and all of us should do everything we can to eliminate political considerations from those decisions. But as each one of us are responsible to our constituents to ensure that we are doing our best to ensure our constituents have faith that we are spending their money wisely. We are sort of, in a sense we are trustees of the public treasury. I do think it is important that the NSF do everything you can to be careful when the awards that you give out. Do not do anything to damage your sterling reputation. Always think about how would a taxpayer see this research? If a taxpayer reads about this on the front page of the New York Times, or reads about it, what would be the reaction of the average taxpayers to how you are spending their money? I think the reputation of the NSF is the greatest in the world and we will do everything on this committee to help protect you from political influence, whether it be from the right or the left. But do be keenly aware—you have a marvelous reputation to protect and be conscious that dollars we spend are hard earned and very precious and very scarce. From my perspective the most important thing is to ensure that none of the grants that you give are going to do anything to damage or diminish that sterling reputation, that you are following the facts and letting science lead the National Science Foundation——

Dr. CORDOVA. Mm-hmm.

Mr. CULBERSON [continuing]. To discover the true nature of the universe. The cutting edge research that you have, we can continue to fund it and have the faith and trust of the taxpayers.

Dr. CORDOVA. Great. Well, I am hoping, Mr. Chairman, that our recent instructions, our guidance as of the beginning of this year—it came out at the same time as the new OMB guidance at the end of December—our guidance to investigators to now have a non-technical part of their abstract that will directly address how the science that they are proposing serves the national interest will really serve to have that moment of focus in which we all take cognizance of what you just said, how important it is to do just that.

Mr. FATTAH. Mr. Chairman, if you would yield for just one second, because I think that the Congress—and as President Truman signed the National Science Foundation into existence—the Congress set it up so that it would be a merit-based process with the National Science Board and so on. I do not think that is divorced from political guidance. So, when President Kennedy went to Rice University in 1961 and said, you know, we are going to put a man

on the moon, given that is our policy direction from an elected official about direction and where we are going and what we are going to do; that is not trying to be an engineer, though.

So, I think there is a happy mix. There are issues that are important to the country and to the country's, you know, challenges that the Congress needs to set appropriate direction, but I do not think that we should ever get in the middle of discerning, you know, from a merit-based process, you know, what science might be. I mentioned this point earlier about a scientist funded 30 years ago to look at what neurons might fire in the brain of a monkey, that would have been laughed at on the floor of the Congress, but nobody is laughing now because it is helping people to be able to control movement through their thoughts. But this is the same absolute same researcher, research staff and focus from three decades ago, so, you know, we have to find a happy marriage, and I trust my Chairman, as we go forward.

Mr. CULBERSON. And we will do it together, arm in arm. That is why I have also been such a big believer in the decadal surveys as the gold standard—

Dr. CORDOVA. Yes.

Mr. CULBERSON [continuing]. As the North star by which we should guide our strategic plan for the decade ahead, whether it be in heliophysics, astrophysics, the earth sciences, the planetary sciences. I would love to—I really and sincerely ask the subcommittee's help and anybody out there to help us figure out how do you do a decadal survey for the manned space program? I do not know how you conquer—untie that knot. The decadal survey is designed to identify strategic goals for the decade ahead that are apolitical, based on the merits, in a peer-review process. That is what I know all of us on this subcommittee want to see the National Science Foundation do in the precious, scarce, hard-earned tax dollars that you are responsible for spending. We want to make sure that you are investing them carefully, following a strategic plan like that, that is apolitical and I think that is the intent.

Mr. Honda is correct to point out, we do not want to insert politics into your work. But, with President Kennedy's guidance to the nation, that it was in the national interest to go to the moon and do it first—we are delighted that you are leading the agency.

And I have taken too much time. I want to recognize my good friend from Alabama, Ms. Roby.

IMPROVING STEM EDUCATION

Mrs. ROBY. Thank you, Mr. Chairman, and thank you, Dr. Cordova, for being here today.

I do want to quickly point out I have some family members with me, some cousins of mine from Alabama that are here visiting, and we were walking over—I am dragging them to all my hearings. I want them to see Congress at work, and I have explained this is sometimes the only exercise we get, running up and down these concrete halls in high heels.

But, we were talking on the way over, as I was explaining what this hearing was about, they are the beneficiaries of STEM education, which is what I wanted to talk about today, and I understand my colleague, Mr. Jolly already touched on this a little bit,

but, you know, efforts to improve and advance science and technology, engineering and mathematics is a top priority for me.

And in my home state of Alabama, I have witnessed how STEM education can be used as an effective and innovative tool in the modern classroom. I was at a school in Huntsville, Alabama, where the partner with the school, at a STEM elementary school, and they were learning how to make a mechanical finger. It was very impressive stuff. And I understand that in this year's National Science Foundation's budget, you provide a total of \$1.2 billion for STEM education.

I am interested in learning more about your new initiative to improve STEM and mainly, as it relates to traditionally underserved students. So, I know Mr. Jolly touched on this, but if you do not mind?

Dr. CORDOVA. Yes, he did.

No, I would be very happy to do it, and let me also welcome your family members here.

Mrs. ROBY. Thank you.

Dr. CORDOVA. It is good to see you.

And I would like to point out to them that the leader of our STEM initiatives, Joan Ferrini-Mundy—Joan, if you would raise your hand—is here. Yes, is great that you brought them here.

So, yes, we do—so, let me say to all that we—the NSF spends considerable monies across all the directorates—it is not just in Dr. Ferrini-Mundy's division—on what we call broadening participation. And that is to encourage students at all age levels, young and older, to get involved in STEM—science, technology, engineering, and math—and perhaps just be happy to be inspired by it, like I was inspired by looking at the night sky when I was a young woman. And that encouraged me to become an astrophysicist, where I could ask questions and do studies of the stars and galaxies, or even become a scientist or engineer.

And so we have many, many programs, and in the new budget that we are proposing,—one of our four major initiatives is called INCLUDES; it is an acronym, but it also just stands on its own. It is to include more people in the whole science and engineering enterprise. And what we are trying to do is the following, we have a lot of great efforts going on everywhere I go across the country, and I do make many visits to universities and colleges and schools. I see wonderful outreach efforts, everything from science fairs to very sophisticated involvement of undergraduates and graduate students in science.

And what we do not see, what we realized is lacking, is that other places do not know of these great efforts, and so we are trying to build, as I know the Chairman has asked us to do so, an on-line resource, for one thing, so that teachers—I have a daughter who is a teacher of young students in elementary school—so that they will have the tools that they need in order to help students do more experimentation, enjoy science, and really understand better, the scientific method that leads to discovery and innovation.

So INCLUDES is an effort to network all the good stuff that we are already doing across the country in a much more profound way in order to raise the next generation to be more involved and knowledgeable about science and engineering.

CYBERCORPS: SCHOLARSHIPS FOR SERVICE

Mrs. ROBY. That is great, and I appreciate you taking the time to go through that with me.

My time is going to expire, but very quickly, the cybersecurity has become you know, very important, a major career in this century and many of our youth are fully engaged with cybertechnologies at a young age. Can you give us an example of how, examples of how NSF's CyberCorps: Scholarships for Service programs have allowed students to advance—and my time is expired—to advance into careers of cybers?

Dr. CORDOVA. Yes, and we will be happy to give you the details on that. We have made a big investment in that at the urging of Congress, that our students who are getting more cybersecurity education are then getting the opportunities to work for those agencies that are really very involved in it, and we think this is a great contribution to the nation. And when I talk with university presidents, it has actually encouraged them to have new curriculum in their universities for students who want to learn more about cybersecurity. It is obviously something that is incredibly important to us on a very personal level, if you buy something online, and a much bigger level, when it comes to agencies and companies and all the assets that they have. We want to protect them, so, yes, we have a big commitment there.

[The information follows:]

The CyberCorps: Scholarship for Service (SFS) program funds scholarships for undergraduate and graduate students and institutional capacity-building at universities in cybersecurity education and workforce development. Ninety percent of the NSF SFS-funded students gain real-world cybersecurity experience as interns prior to graduation, and 91 percent of SFS students obtain cybersecurity jobs upon graduation. In both cases the internships and positions are primarily with federal and state agencies. The majority of graduates work with the National Security Agency (29.8 percent), Department of Defense (19.9 percent), and Federally Funded Research and Development Centers (16.4 percent); they are employed at 36 federal agencies.

Students have reported that they obtained their jobs primarily as a result of the internships, the annual SFS jobs fair, and networking. Based on survey responses students and graduates are overwhelmingly satisfied with the quality of SFS courses and faculty. SFS students report that key elements of the programs offered by their colleges and universities are essential for their entry into cybersecurity positions. Examples include: brown bag sessions with professionals from the cybersecurity industry, a range of networking opportunities, visits and shadowing activities arranged to get to know agencies, and research-based coursework that allows for hands-on activity in cybersecurity problems. Such experiences all contribute to SFS students' readiness and excitement about entering this field. The graduation rate among SFS students is 97.1 percent, in part because of the structures provided for them at their universities. Nearly half of the SFS graduates already have achieved a professional certification in cybersecurity. About 82 percent of the SFS graduates have stayed in their positions longer than obligated by the grant.

Out of the total 58 CyberCorps: SFS schools, three are in the state of Alabama. These are the University of South Alabama, University of Alabama at Huntsville, and Auburn University. According to Dr. Alec Yasinsac, Professor and Dean of the School of Computing: "The University of South Alabama created an entire undergraduate degree program in Cyber Assurance (<http://cyb.soc.southalabama.edu/>) and added Information Assurance concentrations to two Master's degree programs because of the opportunities the CyberCorps: SFS program provides. Our students have been employed in cyber security positions within the FBI, Department of Homeland Security, the Social Security Administration, and Lawrence Livermore National Labs. We have also placed students in internships at the National Programs Protection Directorate, Naval Postgraduate Research Lab, General Accountability Office, Pacific Northwest National Labs, Air Force Research Labs, and Sandia Labs."

Mrs. ROBY. To international security, as well.

Mr. FATTAH. If the Gentlelady would yield for one second?

Mrs. ROBY. Yes, sir.

WOMEN IN THE STEM WORKFORCE

Mr. FATTAH. One of your questions about STEM education, one of the areas is how to get more young women. And as one of the leading scientists in the world, you, obviously, are in a unique position, but the Foundation has set up some additional policies to make it more likely that researchers can stay and do the work they do, notwithstanding some of life's circumstances as they develop.

I was in Israel last week and I met with the head of the Weizmann Institute and they have a very interesting program where because sometimes when they are trying to track women scientist, they have challenges with the family making a decision, and so they just decided, Mr. Chairman, to do it the old-fashioned way, and they increased the offer by fifty percent and they have been very successful. I met some great scientists there.

But if you would talk a little bit about some of the policies that have been implemented and how that has helped the Foundation in this regard, that might be useful.

Dr. CORDOVA. We do have a program called ADVANCE, which is a program at universities to help women go through the whole university pipeline. I was actually the principal investigator for that program at Purdue University, and this has been extremely successful in ensuring that women are given every consideration in advancing along from being post-docs to beginning professors and then eventually full professors.

We also have a lot of family-friendly policies that we have adopted in our Career-Life Balance program, and that is available to our young scientists called career scientists and our post-docs. And I, again, in going around to universities, I always meet separately with groups of young women or young career scientists and minority scientists, as well, to listen to their particular struggles and how well is NSF doing in providing them with lifelines. They are very, very pleased at the Career-Life Balance. This means if they are going to have a child, we do some special things to give them extra consideration for timing and extra money for technical support. So we actually do give financial resources to help with their balance of life and career.

Mrs. ROBY. I guess I will yield back.

Thank you, Mr. Chairman.

Mr. CULBERSON. Of course.

DR. CORDOVA'S EXAMPLE IN STEM

To follow up on those worthwhile questions, I would just like to ask you an open-ended question. Tell us a little bit about your own story, for the young ladies that came in with Ms. Roby and other young people watching you here today. Tell us a little bit about your early life and what led you to make the decision to become a scientist and what led you to Stanford and then what led you on to Caltech, two great universities.

Dr. CORDOVA. Let's see, so how much time?

Mr. CULBERSON. No, in thinking in terms of who is listening to you—

Dr. CORDOVA. Yes, of course.

Mr. CULBERSON [continuing]. These young ladies out here—what inspiration, guidance, advice can you give them and other young people?

Dr. CORDOVA. Thank you.

Well, first of all, I think inspiration can come from almost any source, and it has been very interesting to me in my own career. My first inspiration was—this was before we had Google—was in something called the World Book Encyclopedia. Anybody remember that? Yes. And so I was doing a science fair project and I opened it up to the atom and I saw the Bohr model of the atom, which any scientist will tell you is not a very good model anymore, but it was the questions. When I saw that the questions you ask are “How do we know that?” That is such an important question. When you hear about discoveries that are made and if you say that is amazing, how do scientists know that that is true? Well, the whole pursuit of science is about finding out the truth, and the truth is beautiful. I mean, that is the other thing that you learn, is that when you discover something for the first time.

And so to rapid, fast-forward my own career, in graduate school, when I was getting all null results on a class of star that I was looking at with telescopes on satellites, I was notified by an amateur astronomer that one of my star systems—they are binary systems—went into outburst. And I had enough chutzpah to confront my advisor and say, Let’s use the last remaining gas on this telescope—it was managed by NASA Goddard Space Flight Center—to point at this object because I think you are going to see something extraordinary from it.

And he said, How do you know that? Well, fortunately, I had done the reading of the theorists about what could happen, so I crossed my fingers behind my back and I said, Trust me, I am your graduate student, I know this. And they pointed the satellite there and it was amazing—it was the first discovery of soft x-ray pulsations from a close binary star, and the signal-to-noise was something like 200, so it was not just a little minuscule signal in the spectrum; it was an enormous thing.

Mr. CULBERSON. You could detect it visually?

Dr. CORDOVA. Yes, visually by amateurs dating back to 1855 that would go into these optical outbursts. Nobody knew they were binary stars originally, but then they surmised that, and nobody knew that they would produce these copious x-rays because you have a degenerate star accreting mass from another star. So the degenerate star would, say, be a white dwarf that would accrete mass from a red star that was very close by, as close as the earth-moon connection. And all the physics that you learn in that process is just extraordinary.

So like anything else, one thing leads to another. But the process of discovery—so let me just share with you one more detail. So I was at Caltech at the time as a graduate student, and as I said, my thesis was all null results until that point, and I was over the top. So I went home—my parents lived close by in Pasadena—and my mother was in the kitchen. We have 12 children in our family;

I have to set that stage. I came in and I said, you know, Mom, guess what happened? And I told her about these stars and the whole thing and she came up to me, put her hands on me and said, France, I do not understand a word of what you are talking about, but I understand that it is terribly exciting and I am just thrilled for you, and gave me a hug. So, you know, discovery is a beautiful thing and it leads many other scientists on different pathways and that is what it is really about.

Mr. FATTAH. Well, it is fascinating, Mr. Chairman, it is so fascinating that you asked this question. I am so happy, and I am going to capture that and put that up on my Web site so that school kids in my district can hear your explanation. But it is really this intersection between observational and theoretical astrophysics that really is your hallmark, so I think that for us, it is, you know, we are in the same space, we are in a different game, but it is somewhere between the observation and theoretical that we are going to work through your budget requests, and thank you.

Mr. CULBERSON. And you often do not know where the research is going to lead, it may look like it is a dead end or a rabbit trail, but it could lead to revolutionary new discoveries. And particularly in this era of interconnectedness with the extraordinary advances in communication using—I mean these devices are now everywhere. I know that the work you have done in high-energy astrophysics—

Dr. CORDOVA. Uh-huh.

Mr. CULBERSON. They have only recently, because of the Internet, be able to tie gamma ray bursts when an amateur astronomer spots a visual—

Dr. CORDOVA. Right.

Mr. CULBERSON [continuing]. Outburst, because of the speed of the Internet. Telescopes all over the world and satellites are able to do today what you did intuitively as a graduate student, and shift the satellite or the ground-based telescope over—

Dr. CORDOVA. Automatically.

THE BEAUTY OF INNOVATION AND TECHNOLOGY

Mr. CULBERSON. To see what a gamma ray burst is. Talk to us a little bit about and the value of the Internet and bringing— tying together young people who you are talking to over the Internet and these young folks, that their work that they are doing as amateurs, can have a dramatic impact on—

Dr. CORDOVA. Could you hold that up once more so while I talk?

Mr. CULBERSON. Yes.

Dr. CORDOVA. So this device [cellphone] that the Chairman is holding has many technologies that make it successful—not just one—everything from the plasma screens to the electronics to the batteries and so on. And on every one of those, I believe, the National Science Foundation has funded the initial basic research that went into that.

What Steve Jobs did when he put together these devices originally was to bring him and his team, bring all those technologies together. And that is another amazing thing about innovation, is it takes many different discoveries, and it is this, what if I put this with this, And what could I create? And also, I might say he was

also an artist—he took calligraphy in school—and so he developed this beautiful optional choice of font systems and all that we have.

Mr. CULBERSON. Beauty is an important part of the design.

Dr. CORDOVA. Beauty is what makes it possible for a woman to have that in her purse and you to have that in your pocket and it does not take up, you know, as much space as a desk.

Mr. CULBERSON. Soon on our wrists.

Dr. CORDOVA. Yes, and soon on our wrists or on our glasses.

So this is very important to put together all of these technologies to develop these products.

Mr. FATTAH. Chairman, if you would just yield if just one last second?

Mr. CULBERSON. Oh, no, please, continue.

Mr. FATTAH. This is just because in the Chairman's state, they have this event, South by Southwest.

Mr. CULBERSON. South by Southwest.

Mr. FATTAH. Yeah, so we do not have that in Pennsylvania. We have to work on that.

But to make your point, right, you know, there was a company that rolled it just 48 hours ago, a flying car deal, right, that puts together the Google self-driving car technology with aviation's well-known automatic pilot take-off and landing, and they have a concept that would have this car in 800 yards take off and land somewhere, and you do not have to have human interaction; that is, that the car self-drives, and the aviation side is autopilot, and it is the combination of technologies that heretofore, were separated, being united, which makes your point, which is why we have—even though I am interested in neuroscience, we have to invest in science broadly in order to make real achievements, because we really do not know in every instance what is going to come of it.

Dr. CORDOVA. Absolutely.

Mr. CULBERSON. Absolutely.

Mr. HONDA. And you guys are talking about my district, you know that. (Laughter)

You got to remember that GPS has a part of this, so we have the aeronautics portion of being able to move cars around.

Mr. FATTAH. Well, you started this with the T-shirt deal, so this love-fest has been going.

Mr. CULBERSON. Mr. Jolly, any follow-up?

Mr. JOLLY. No questions.

NEW NSF HEADQUARTERS

Mr. CULBERSON. We have a couple questions about NSF headquarters. I can certainly submit those for the record. I am concerned about the slippage in about six months and \$60 million, according to the Inspector General. Does your budget request—I would ask very briefly—include that those costs that you are expected to incur as a result of the move and the—

Dr. CORDOVA. No, this budget request is for this [FY16] year. Just a couple of sentences about the background. The whole shell of the building will be built out by this fall, and our current budget request is for information technology and furniture and those sorts of things to get those all ready for the move-in. Any costs incurred by delays, which actually, we are now through a lot of work and

a great head of that office that I hired recently, has made a lot of progress in moving back from the worst-case scenario. You were quoting kind of worst-possibility numbers, so I am looking forward to this. Those will come in the fiscal year 2017 request, those kind of delays.

But this year's request has to do with the things that GSA requires us to do in order to be ready for the building, which will be all shelled out by this fall.

Mr. CULBERSON. Your 2016 request does not include any of those increased costs that came about——

Dr. CORDOVA. No.

Mr. CULBERSON [continuing]. As a result of the union negotiations?

Dr. CORDOVA. No, and as I said, we are really trying—working very hard to mitigate those, and as you can imagine, GSA is a great partner in that.

Mr. CULBERSON. Do any of the—do you need all of the IT and furniture funds requested in 2016?

Dr. CORDOVA. In 2016, yes; that is my understanding, because they are long-term procurements.

DESIGNATING FUNDING BY DIRECTORATE

Mr. CULBERSON. There has been some discussion, some other members of Congress have suggested that we recommend specific science research directorate funding levels in your appropriations. We typically have not done so in the past, and would like you, if you could, to address that. Should Congress designate funds by science research directorate and how would that impact a peer-review process?

Dr. CORDOVA. Okay. This is a really big deal.

When we last did this, I believe it was in fiscal year—when Congress last did that, it was in fiscal year 1999. Our budget for NSF was half of what it is now; it was \$3.69 billion.

Mr. CULBERSON. However, grant requests were far smaller.

Dr. CORDOVA. Far smaller. It was around half, around 30,000 proposals, as compared to over 50,000 now.

So that is one thing to really keep in mind, the whole business of the merit-review process, the recognizing as we have all alluded to: the decadal reports, and the workshops and all the community input; that is a many-months long process. We start thinking about our fiscal year 2017 requests and how to do that starting in April, and that is at my level. The directorates have already been thinking about how to put together the budget, sweeping together all of these kinds of inputs.

And so the other thing—it is a very time-consuming process and I cannot imagine that if we had directorate-funded levels, then, do you really want all of those scientists and engineers in your office asking about—we will not use the lobbying word—but asking about setting priorities? We have these decadal types and other review processes, you know, in ocean science and planetary science and astronomy and astrophysics and so on. I have been tremendously impressed since I have come to NSF at how cross-disciplinary and working together all of the assistant directors who head the different directorates are, and they make these decisions about what

to do and how to work together in order to leverage resources and make progress in certain areas that are deemed of great importance by the scientific communities, in a very rational, reasonable way.

And we have retreats on this. I went away for a couple days, twice last spring/summer with the ADs to really mull in detail how to put together a very good budget. We have spent much of this hearing talking about the nature of discovery and how one thing can lead to the other and you have to be very responsive. And we are able to do that because we have the flexibility in the directorates by working together to be flexible to be cross-directorate, and also to put the budget together through the wisdom of the program officers and directors on staff, together with all this other input.

And I think it would really be a different situation for Congress to have everybody in their door asking. I mean how do you choose, Mr. Chairman, between one telescope and another telescope? We have already had some telescopes discussed, at least four of them, at this hearing; how do we choose the priority in Congress without some, you know, decision-making process of NSF between a telescope and a ship? And there are just so many decisions going down to very small level in STEM education to, you know, the biggest facilities.

Mr. CULBERSON. Those are all very valid concerns and we do want to do everything we can do prevent politics from being inserted into your decision-making process. And I think it is also vital that we recognize that NSF, NASA, the scientific experts that space—the space exploration and scientific research that the nation does is a strategic asset to the entire country, and I think it is important for none of us—none of us should think that the work that you do or NASA does as either a jobs program or a parochial or a local issue; it is in the national interest. And by investing wisely and sufficiently in both the National Science Foundation and NASA, you are going to help all of those districts all over the country. So I think those are very valid concerns.

DEVELOPING THE NSF BUDGET REQUEST

I would also like to ask about the—when you begin to put your budget together, for example, for next year in April—you are already beginning to kick that around right now—I assume at some point during the year, you have got to submit what you believe NSF will need next year to the Office of Management and Budget and then the final recommendation that we receive in Congress comes from OMB.

One thing that has always aggravated me is we do not get a recommendation directly from the scientific community when it comes to NASA or NSF; we are hearing from OMB, and we ought to be hearing from you. Legal Services submits their budget recommendation directly to the Congress.

Dr. CORDOVA. Uh-huh.

Mr. CULBERSON. What would be your thoughts on having NSF—I would like to see NASA submit their recommendation directly to us and bypass OMB, so we are hearing the best recommendation of the minds in this space community, as to what this committee

should fund. What do you think about having NSF just submit your budget recommendation based on the best recommendations of your team and following the decadal survey, directly to the Congress and bypass OMB?

Dr. CORDOVA. Mr. Chairman, I listened carefully to your——

Mr. CULBERSON. Speaking as a scientist. [Laughter.]

Dr. CORDOVA [continuing]. Remarks as I——

Mr. FATTAH. If the gentlelady would yield for a second?

Dr. CORDOVA. I always will.

Mr. FATTAH. I think it was a social scientist named Banfield who wrote a paper a long time ago called Metaphysical Madness, right? And it was really the choice between what political people would come up with and what empirical science would, you know. And he figured out that we would probably end up at about the same place, notwithstanding, you know, whichever way you get to it, Mr. Chairman.

But, you know, I think that for administrative witnesses and administration witnesses, it is difficult for them.

Mr. CULBERSON. It is difficult.

Mr. FATTAH. Step outside of their role and speak, because they are here representing the Administration.

So I just yield back.

Mr. CULBERSON. That is true. But speaking as a scientist——

Dr. CORDOVA. Thank you. Thank you. [Laughter]

Speaking as the head of the National Science Foundation, I agree.

Mr. CULBERSON. I would sure like, as a matter of policy——

Mr. FATTAH. It is a great paper; it is called Metaphysical Madness. The scientist's name is Banfield.

Mr. CULBERSON. As a believer in letting the scientists lead this work without political interference and then following and funding the best recommendations of the best minds in the business, I think it would be a wonderful thing for the future for us to find a way to have the National Science Foundation and NASA submit your recommendations on what you think your funding level needs to be directly to the Congress and bypass the green eye shades over at OMB, so we know what you need.

Dr. CORDOVA. For the record, I do not have any comment on that. [Laughter.]

Mr. CULBERSON. Mr. Honda.

DEVELOPING DIVERSITY IN STEM

Mr. HONDA. Or, you know, just jumping in this thing now. I think Congress probably has a fiduciary responsibility to produce a balanced budget that would reflect the entire values and aspirations of this country first so that the different departments and activities of this government will have resources from which to operate. And I think that since 2009—I may be wrong—but 2009, we have not had a, what you call a real budget, and we have not had a balanced budget for the longest time.

So I think operate on the CR, but we move forward based upon past decisions. There is really a reduction in funding, and if we want to see increased funding and a broadening of our vistas to go beyond the moon and go towards Mars and Europa and places like

that, we are going to have to put up or shut up. And I think that, you know, that is where the primary responsibility lies; it is with us.

And I really appreciate the difficult position that all of you folks find yourselves in wanting to do—to reach for the stars without being tethered, and I think that the Chairman and the ranking member also agrees that this is what we—this is a dream that we would like to see because it really turns us on.

And you mentioned different programs and several were touched on teaching and learning programs, and I think that one of the areas that NSF is helpful in creating opportunities through programs like LSAMP and Noyce that encourages STEM majors to become K12 teachers, STEM teachers. Having said that, and from your own background experience, I assume Latina, and also the aspiration of this country when we say that we want to have more underrepresented folks in the area of STEM, what are some of the things that we need to look at as congressional members to allow NSF to have that flexibility to move forward and encourage, recruit, put yourself out in front of populations that are underrepresented in the STEM field?

I don't know if this question is clear, but, you know, I am just trying to meld, again, our understanding of society, which is social sciences, and the need for more representation in the STEM field.

Dr. CORDOVA. To be a competitive vibrant nation, we do need to have all citizens engaged and certainly to have the access to science and technology and learn about those wonderful careers. So that is really what our initiative called INCLUDES for the fiscal year 2016 budget is all about, taking the different pieces, and you mentioned a few programs. We have a number that either focus on minorities, women, the disabled, or emphasize them more indirectly—taking all of those programs and maximizing their efficacy by tying them together and linking what we have learned in best practices so that knowledge base becomes something that everybody can use.

So it is really about scaling up our efforts. That is the biggest challenge that we have in the United States. It is not that we do not have wonderful universities and high schools in our various districts doing great things, but we have so many that have no idea and could really benefit from what we are learning.

So I have actually challenged our engineering directorate to help us think about a more systems-approach to expanding that knowledge base and those best practices. First, define what we know through evaluation and assessment, what we have learned, and then ensure that there is a network so that it connects with others so they can learn about how to do programs. Especially to marry programs to whatever their asset base is in their communities.

This is also going to be a community-action approach where we call upon local groups and mayors and even governors to work with our science and education from kindergarten through university to work on this.

Mr. HONDA. Yeah. In the counts of equity, a lot of our STEM programs start from fifth and sixth grade and I think that we ought to look at neighborhoods and populations pre-K to third and fourth grade where we lose a lot of the youngsters that we say that we

want to target. And in terms of equity, also, we seem to go towards districts and schools where there are programs already operating in, and with equity in mind, equity and resources, having NSF target their resources, both financial and human resources, towards school districts that are underperforming, but we know that there is potential there if you apply that resources that you have to schools like in impacted neighborhoods.

And I think that is how we can bring NSF and Silicon Valley to Philadelphia and other places that we need to put our efforts in so that we can prove that there are youngsters there that can be successful in the STEM area, but we just haven't put the resources in there. And I think equity is one of those things that may be a principle that NSF may want to look at in terms of the distribution of the resources.

Dr. CORDOVA. That is a point very much on the mark and we have been doing that, and actually, from the initial conception of this, we have expanded it to include the whole socioeconomic equation and equity, and I couldn't have more passion around this having my own children involved as teachers in these kinds of challenging school districts. So I have the vision of them in front of me as—

Mr. HONDA. Great. Thank you.

Mr. CULBERSON. Mr. Fattah.

Mr. FATTAH. I will submit some questions for the record, but thank you very much.

Mr. CULBERSON. I just want to thank you again for your service to the country. The National Science Foundation is a national treasure and we will do everything we can to help protect you, to fund you at a level that you need to continue to do the great work that you have been doing.

OMB could certainly submit their own recommendation, but I am certainly going to do everything I can to change the law so that we get the best recommendations and the best minds at NASA, the space exploration community, and the scientific community when it comes to NSF, so Mr. Fattah and I and our colleagues know you think you need for the future, not what necessarily—does not matter who is in the White House—what the bureaucracy thinks that you need, with as little political interference as humanly possible. I deeply appreciate your service.

Dr. CORDOVA. Thank you very much.

Mr. FATTAH. Mr. Chairman, this idea is growing on me. It is growing on me.

Mr. CULBERSON. No matter who is in the White House. [Laughter.]

Dr. CORDOVA. Thank you for your leadership.

Mr. CULBERSON. Thank you, ma'am. I appreciate your service.

And the hearing is adjourned. Thank you.

Attachment 1: Demand to Bargain

Demand to bargain the new NSF building by Local 3403, American Federation of Government Employees.

Background: Sometime in late 2016, the National Science Foundation will relocate to the parcel of land known as Hoffman Center in Alexandria, VA. This move was announced by GSA in June, 2013. The lease on the new building provides in one building approximately the same amount of space currently occupied by NSF in two buildings. NSF Management has shared with the Union the size and location of the new building, a design concept that reserves committed and shared space on each floor, several floors reserved for a conference center, and test fits that show Management's current design concept does not allow employees the same amount of work space they have in the current location. The Union submitted proposals concerning the size of individual work spaces in September, 2013 as a first step in negotiating the change in conditions of work when NSF bargaining unit employees change their location of work. In view of the failure of the test fits conducted by the architects to accommodate all employees, the Union first questioned the number of work spaces being included in Management's plan. Using accurate personnel information from NSF's Division of Human Resource Management, the Union pointed out that the number being used was too high. Management then reduced the number of work spaces accordingly. The Union has shared with Management documentation showing that, based on the new personnel numbers and information from the developer's architects of usable space on each floor, it is not necessary to reduce the space of any bargaining unit employee below 81 SF, the current size of the smallest work space occupied by bargaining unit members in the current building. Office sizes in the current building vary greatly and are much larger than typical offices in the Federal government. The Union's proposal contained smaller offices but no reduction in the cubicle size. No negotiations have taken place on the Union's proposals and the Union has recently learned that the schedule for NSF to make decisions on final floor plans is in May, 2014. This demand to bargain is being submitted to protect the Union's right to bargain all changes to conditions of work at the new location.

Demand to Bargain: The Union is requesting a response from Management within one week of receipt of this demand to bargain to avoid any delays that will be costly to the Government. For each proposal, the Union requests that Management reply if management (1) has a duty to bargain, if not, why not; (2) if the Union's proposal is negotiable, and if not, why not; and (3) are the parties at impasse on the proposal?

Received by:

Jolaina Jeff-Cartier, Labor Relations Officer, National Science Foundation

Date

Attachment 1: Demand to Bargain

1. The Union proposes that all bargaining unit employees will be assigned lockable individual work space unless they telework regularly more than 3 days per week. BU employees grade AD-4 and GS 15 will occupy offices no less than 135 SF, grade AD 2-3 and GS 12-14 will occupy offices no less than 100 SF, and other grades will occupy DIRT cubicles no smaller than 81 SF with walls at least 84 inches high as measured from the floor. All offices and cubicles will have individual doors with locks and employees will be given a key to the lock on their work space. All work spaces for BU employees will have sufficient and convenient electrical service so that it is not necessary to crawl along the floor to use the electrical outlets. Employees will have at least 3 choices of office furniture, including desk height, color, and style of partition at a minimum. Choices will be determined once floor plans are available. Workspaces for bargaining unit employees throughout the building will be assigned based on organizational unit at the level of directorate or office, grade, and time at NSF. Employees will have the right of tenancy once they select a work space unless they permanently leave the work unit for a new position or have elected to be on detail or long term development assignment for more than one year. When vacancies occur, employees will be given the choice of selecting a new workspace in the same order as the original selection process. Tie breakers will include, in the following order: total Federal government service, earlier Entry on Duty Date, and if needed the flip of a coin.

Each division will have available treadmill work stations for at least 33% of the number of their bargaining unit employees to be shared on an equitable basis if over-subscribed.

2. Employees who have successfully been regular teleworkers for at least one year, success being defined as maintaining the same or higher performance appraisal when teleworking more than 3 days per week as when not teleworking at all or teleworking less than 3 days per week, may be eligible for hoteling, defined as intermittent use of an 64 SF cubicle. The hoteling work spaces will be centralized on each floor at the south end of the building in the center of the floor, except for upper floors of the tower structure, in which case any hoteling work spaces will be negotiated by floor.
3. Employees who choose to hotel will be assigned a locker no smaller than 100 cubic feet in size with an electronic lock activated by the employee's ID card.

Attachment 1: Demand to Bargain

Hoteling employees may reserve work space for up to 30 days and after hoteling successfully for 6 months may be granted regular use of the hoteling space unless they choose to maintain the 30-day reservations system.

4. NSF will provide no less than 500 parking spaces for bargaining unit employees, with at least two-thirds of them in the NSF building. Monthly parking fees will be paid by payroll deduction and will equal in dollars the square footage of the employee's work space, unless the employee is not permitted to telework, in which case the employee will not be charged for parking. BU employees will have ready access to charging stations in the garage without paying any additional amount. If parking is over-subscribed, a system will be instituted that encourages carpooling and van pools, accommodates special needs, and otherwise ensures equity and fair treatment of BU employees. Any system that needs to be developed will be negotiated with the Union and include at least half of the members of the committee appointed by the Union.
5. Employees who regularly telework more than 3 days per week will be eligible for free parking at NSF on the days they are at NSF and do not telework.
6. NSF will provide an on-site, affordable child-care center with a capacity of 125 children including a minimum of 25 infant slots and lactation rooms, to be located on the first floor of the new building.
7. NSF will provide a full-service cafeteria that seats 500 and includes healthy options and dietary-specific menus and operates from 6 a.m. until 4 p.m. when NSF is open.
8. All vending machines must include healthy options, and the number and placement of such machines, if any, not reduce the space occupied by bargaining-unit employees for doing their work. Once final floor plans that show the configuration of work spaces have been received, the number and placement of the vending machines will be negotiated for every floor on which BU members have assigned work space.
9. NSF will provide the Union an office space of at least 600 SF with at least 2 windows. Placement of the Union office space will be negotiated upon receipt of floor plans and blocking and stacking diagrams.
10. NSF will provide all shared spaces in the parts of the building used by BU

Attachment 1: Demand to Bargain

employees a sufficient number of conveniently placed electrical charging stations for mobile devices.

11. Each floor used by BU employees will have at least one unisex, private bathroom with a shower.
12. All bathrooms will have handleless operation of entry and exit doors, faucets, soap dispensers, towel dispensers, and hand dryers. Each bathroom stall will have shelves for personal belongings, and each bathroom will have additional shelves with the fixture or near other fixtures. Each bathroom stall will have toilet seat cover dispensers. Each bathroom stall will have doors that ensure total privacy, are at least six feet tall, have a bottom gap of no more than two inches from the floor, have no gap on either side of the closed door, and have sturdy, reliable locking mechanisms, with at least one sturdy hook on the door. Towel dispensers and hand dryers will be located immediately adjacent to the washbasins so that it is not necessary to drip water across the floor to dry one's hands. Each bathroom will have a full-length mirror.
13. A weather station will be maintained and data from which will be conveniently available for access from the NSF network.
14. Any choice and placement of public art, furniture, and decorations will be negotiated with the Union once floor plans are available.
15. Placement and availability of printers, fax machines, copiers, shredders, and other equipment shared by BU employees will be negotiated with each organizational unit once floor plans are available.
16. Each floor will have 2 shared kitchenettes with microwave ovens, refrigerators, ice makers, garbage disposals, sinks, and seating for 6 people. Cabinetry, counter tops, furniture, and location of such will be negotiated when floor plans are available.
17. A quiet room will be provided with furniture for employees to isolate themselves

Attachment 1: Demand to Bargain

for short rest periods. Size, location, and furniture will be negotiated when floor plans are available.

18. Dedicated rooms will be provided for the EAP and ADR programs. Size, location, and furniture will be negotiated when floor plans are available.
19. The move of BU employees to the new site will be effected over a period of time not to exceed 5 days.
20. IT specialists in the directorates and offices will be provided storage closets of sufficient size for equipment. Placement and configuration of closets will be negotiated upon receipt of floor plans.
21. Following an information request to be submitted on the need for files in the new building, file space for papers files in each work unit will be negotiated.
22. Inasmuch as possible, directorates and offices will be assigned to a single floor with the largest organization unit placed on the largest floor. Relocations of parts of organizations will be minimized with blocking and stacking determined first by sizes of organizations.
23. Lighting throughout the building will be the equivalent of natural light (full spectrum natural sunlight lighting).

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Attachment 2: Arbitrator Opinion and Decision

UNITED STATES

FEDERAL SERVICE IMPASSES PANEL

WASHINGTON, DC 20424-0001

October 23, 2014

BY FEDEX

Ms. Deanne M. Sobczak
Assistant General Counsel
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Ms. Carter Kimsey
President, Local 3403
American Federation
Government Employees
Suite 815
4201 Wilson Boulevard
Arlington, VA 22230

RE: National Science Foundation
Arlington, Virginia and
Local 3403, American Federation
of Government Employees, AFL-CIO
Case Nos. 14 FSIP 100 & 104

Gentlewomen:

Enclosed herewith is the Arbitrator's Opinion and Decision in
the above-captioned case.

Sincerely yours,

H. Joseph Schimansky
Executive Director

In the Matter of

NATIONAL SCIENCE FOUNDATION
ARLINGTON, VIRGINIA

and

LOCAL 3403, AMERICAN FEDERATION OF
GOVERNMENT EMPLOYEES, AFL-CIO

Case Nos. 14 FSIP 100
and 14 FSIP 104

ARBITRATOR'S OPINION AND DECISION

The National Science Foundation, Arlington, Virginia (Employer or NSF) and Local 3403, American Federation of Government Employees, AFL-CIO (Union) filed separate requests for assistance with the Federal Service Impasses Panel (Panel) to consider a negotiation impasse under the Federal Service Labor-Management Relations Statute (Statute), 5 U.S.C. § 7119.

After an investigation of the requests for assistance, which arise from bargaining over the Employer's determination to relocate its headquarters to Alexandria, Virginia, the Panel directed the parties to mediation-arbitration with the undersigned and issued an Order to Maintain the Status Quo.^{1/} Accordingly, on September 16 and 17, 2014, a mediation-arbitration proceeding was convened at the Employer's current facility. During the mediation phase, the parties addressed their interests and positions, and were able to resolve some issues, but the more difficult ones remain. Consequently, the parties have submitted their final offers to me for a binding determination. In reaching my decision, I have considered the entire record, including the parties' proposals, documentary evidence, witness testimony, post-hearing briefs and information

^{1/} The Order, issued on September 3, 2014, directed the Employer to take affirmative action to maintain the status quo while the matter is pending before the Panel, i.e., take steps to curtail finalization of architectural drawings for the interior design plan for the new facility to the extent necessary to preserve the Panel Member's ability to resolve the impasse on the basis of the Union's proposals should the Union prevail on the merits of the issues.

provided during post-hearing conference calls with the parties on October 8 and October 20, 2014.

BACKGROUND

The Employer, an independent Federal agency, awards grants to fund projects, primarily at academic institutions, involving science, technology, engineering and mathematics; it receives approximately \$7 billion annually in Congressional appropriations to fund grants. The Union represents a bargaining unit consisting of approximately 937 professional and non-professional employees; professional employees are mostly project directors or administrators who hold doctorates in their respective scientific fields, and review proposals for grants and convene panels which include other professionals, known as Intergovernmental Personnel Act (IPA) detailees, from outside the Agency to review requests for grant funding. Other bargaining-unit employees hold a wide variety of positions and provide administrative assistance to further the Employer's mission. Employees are paid under either the General Schedule or a pay banding system known as an AD schedule. The parties are governed by a collective-bargaining agreement (CBA) which they renew annually until it is replaced by a successor agreement.

In 2009, the Employer and the General Services Administration (GSA) began the process of drafting a Program of Requirements (POR) for the solicitation of office space for NSF inasmuch as the leases for the buildings it currently occupies are to terminate in 2016. It appears that the Union was not consulted during the process and the POR was issued without the Union having knowledge of its contents. Several staffing scenarios were included in the POR, but the Employer ultimately selected one that would accommodate 2,241 persons. Subsequently, representatives of the Union filed a request under the Freedom of Information Act (FOIA) to obtain the details of the Employer's requirements for a new headquarters building.^{2/}

^{2/} According to information provided by the Employer during a conference call with the parties on October 20, 2014, the Employer came to the conclusion that the new building did not have sufficient space to accommodate 2,241 persons. As a result, it has scaled back the number to 2,000 persons, using the following breakdown:

1,423 Full-time Equivalent (FTE) employees
197 IPAs

After reviewing bids in response to the POR, on June 7, 2013, GSA selected a bid for a new building site in Alexandria, Virginia. The bid included a design for the exterior of the new building, which was yet to be constructed, with usable interior space to be approximately the same square footage as the space now occupied by the Employer. In the new building, the Employer will occupy a portion of the first floor and floors 2^{3/} through

42 Pathway Students
61 Einstein Fellows
200 contractors
77 employees (representing a 4-percent growth rate)

The Union disputes some of the Employer's numbers because they do not include temporary employees and the Union believes the Pathway Students have been counted twice in the Employer's calculations. The evidence suggests that there is no clear number that may be relied upon with respect to how many employees, contractors and IPA staff and others need to be accommodated in the new building or whether the Employer has included in its estimate a realistic number of staff that represent future growth. The Arbitrator's best understanding of the total number of employees that are to have office and cubicle space in the new building comes from estimates which both the Union and Employer presented during the hearing and it appears that the most recent assessment of 2,000 persons may be too high, by about 10 percent, given that other estimates revealed that the total number of staff would be 1,800. In this regard, other estimates presented were for private offices for 1,173 persons, cubicle space for 419, and space for 200 contract employees, for a total of 1,792 work spaces or approximately 1,800 persons. I find this number to be a more realistic assessment, and one that would seem to allow for somewhat larger workspace for employees. Therefore, the architectural test fits which were based upon space for 2,000 persons may have used a number that was 10-percent higher than other estimates presented.

- 3/ The second and third floors are to be devoted primarily for conference rooms where employees and IPAs may meet with prospective grantees who request funding for projects. The inclusion of entire floors for conference room space appears to be an effort by NSF to have sufficient space to convene meetings "in-house," rather than continue the current practice of renting outside space for such conferences.

19, with the exception of a portion of unleased space on the 6th floor. The Employer's seven science directorates and two business offices where bargaining-unit employees work, will be located on floors 4 through 14.

Impact-and-implementation bargaining between the parties over the "35-percent design" plan (the initial stage of space planning that covers 1/3 of the complete design) was late in starting. On at least two occasions, "tests fits" were conducted by the interior design architect to determine whether the Union's proposed office sizes of 130 square feet (SF) and 100 SF, and cubicle size of 80/81 SF, could be accommodated. At least one test fit was based on office space for 2,002 individuals. On both occasions, the conclusion was that the office and cubicle sizes proposed by the Union would not fit by a significant amount.^{4/} GSA delayed the construction schedule while the interior design architect performed the test fits but, on September 22, 2014, it determined that no further delays could be tolerated and GSA issued to the developer a "Notice to Proceed" that required an interior design plan to be based upon 120 SF offices for approximately 1,173 bargaining unit (BU) and non-bargaining unit (NBU) employees, and 64 SF cubicle workstations for 419 BU and NBU employees. On two occasions, September 11 and 30, 2014, the Employer requested that GSA maintain the status quo while the matter is pending before the Panel but, apparently, GSA does not appear willing to agree to the NSF's requests.

ISSUES AT IMPASSE

The key issues involve whether GS-12 employees should be assigned to offices or cubicles and the size of their space, and

^{4/} It is undisputed by the parties that when the test fits were prepared by the architect, the space proposed by the Employer for panel conference rooms, team rooms, kitchenettes, refreshment centers, other shared meeting space on each floor, and file and storage areas were drafted into the plan first, and the office and cubicle space with the dimensions proposed by the Union were added thereafter. The Union maintains that by including its proposed office and cubicle sizes last, the test fits were "designed" to fail and would show a shortage of space on the floors where the test fits were conducted.

the size of cubicles for employees in grades GS 1-11.^{5/} Other matters in dispute are: the height of cubicle partitions and whether cubicle doors should be lockable; the size of kitchenettes (pantries) on each floor; whether there should be "refreshment centers" with vending machines and seating on each floor; the number and size of shared meeting space on each floor; the number of team rooms on each floor; and file and storage space.

POSITIONS OF THE PARTIES

1. The Employer's Position

The Employer proposes the following:

1. GS-12 employees and all other bargaining-unit employees, whose cubicle size remains in dispute, to occupy cubicle workstations no smaller than 72 SF, with partitions no higher than 66 inches, all without lockable doors;
2. Each floor to have two shared kitchenettes with microwave ovens, refrigerators, ice makers and a sink;
3. No more than five floor-shared refreshment centers with vending, and seating for no less than six persons, to be distributed on alternating floors;
4. Floor-shared meeting space to be maintained at current design level, one per floor (20-40 person seating);
5. Team rooms to be allocated at least one per division; and

^{5/} During the hearing, the parties reached agreement that bargaining-unit employees in grades AD 4-5 and GS-15 would occupy private offices no less than 120 SF. Furthermore, they agree that employees in grades AD 2-3 and GS 13-14 should occupy individual offices of no less than 100 SF. Other agreements executed by the parties during the mediation-arbitration hearing require the standardization of office and workstation sizes among bargaining-unit employees across all organizational entities; storage space for equipment used by IT specialists, and dedicated rooms for the Employee Assistance Program and Alternative Dispute Resolution offices.

6. File space to be distributed according to the need of the organization and adjusted to the space available.^{6/}

Essentially, the Employer contends that the 90 employees who are at the GS-12 level should occupy cubicles in the new facility because the prevailing practice for employees at that grade level is that they are stationed in cubicle space. The parties have negotiated eight agreements on work space which place GS-12 employees in cubicles, except for one agreement which allows 11 GS-12 employees in the Math and Physical Science (MPS) Directorate to occupy offices. Continuing to allow a small subset of GS-12 employees to have offices likely would cause some derision among those who are to have cubicles. Furthermore, throughout most of the parties' negotiations, the Union was proposing that GS-12 employees would occupy cubicles and the architectural test fits of the Union's proposals were based on that offer. Implementation of a proposal that would have GS-12 employees occupy offices, rather than cubicles, would require the floor plans to be redrawn and, thereby, result in a significant and unwarranted increase in design costs and construction delays.

The Employer's proposed workstation size of 72 SF should be adopted for all employees at and below the GS-12 level because a test fit on one floor, using the Union's 80 SF proposal, revealed that the larger cubicle size would result in a 40-percent shortfall. It is questionable as to whether even the Employer's proposal of 72 SF for cubicles could be accommodated but, based on information from GSA, management's proposal is more likely than the Union's to fit within the usable space on floors 4 through 14 in the new building. A 72 SF cubicle is adequate for employees to engage in all functions of their positions and the new furnishings for those workstations should provide employees with more storage, leg room, and book shelves

^{6/} During a conference call with the parties on October 20, 2014, the Employer elected to withdraw the following provision which heretofore had been part of its final offer:

Agreement with the proposed items shall not amend any provision in the current collective bargaining agreement unless specifically identified here. Nothing in this agreement shall be construed as a waiver of any right of employees or the Union as authorized by law or Government-wide regulation.

thereby allowing employees assigned to 72 SF cubicles to perform work in the same manner as they do now. A larger workstation would not provide more collaborative space as both 80/81 SF and 72 SF workstations provide room for only one chair. Team rooms would be available should employees assigned to cubicles need to convene larger meetings. No cubicles should have locks because it is cost-prohibitive to purchase lockable panels. In this regard, research reveals that, among the few manufacturers who even offer locking door panels for cubicles, the least expensive lockable panel would cost approximately \$1,200.

The height of cubicle workstation panels should not exceed 66 inches because not only are 66 inch panels currently installed in cubicle space but panels of that height also represent the industry standard and provide employees with sufficient privacy to accomplish their work. There is no need to change the status quo particularly when higher panels are likely to disrupt the flow of heating and air conditioning and impede light from accessing cubicles from perimeter glass.

As to kitchenettes, while the parties agree on amenities for them, the Union's proposal to contain their size to no more than 350 SF of space each cannot be accommodated. The Employer's design plan would place kitchenettes in areas that could not otherwise be utilized as employee work space. Therefore, the Employer's proposal, which does not designate the size of a kitchenette, allows for a better usage of space. Furthermore, the new building also should have "refreshment centers" for vending machines and employee seating because they provide employees with an alternative to going to the cafeteria. Management considers refreshment centers to be a benefit for employees, one that currently is provided to them and should be retained.

The Employer's proposal for one meeting room per floor that accommodates 20-40 persons should be adopted because it is critical to the furtherance of its mission. In this regard, a large meeting room on each floor would provide space for weekly division staff meetings, daily meetings within the Budget office during peak work periods, weekly seminars, meetings among Divisions/Directorates, and serve as panel rooms during peak panel conference meeting time. Such space currently exists to accommodate larger meetings and there is no need to reduce the size or number of such rooms.

Similarly, team rooms would provide the agency with space that is necessary for employees to collaborate and for employees

to meet with small groups of scientists who seek funding or are in need of discussing their research. While employee offices and workstations may be sufficient for holding very small meetings, there is a demonstrated need within NSF for larger space to accommodate small groups. Under the Employer's design plan, there would be at least one such room per division, and the team rooms would be placed in areas that are oddly shaped and otherwise could not be used as office space.

Finally, with respect to filing space, because the needs of directorates and divisions vary, the Employer proposes that the space be allocated accordingly, to accommodate those needs, and that it be placed into areas that may not be appropriate for employee offices or cubicles. The proposal provides the best solution for utilizing oddly-shaped space, rather than specifying a certain size limitation on filing space areas.

2. The Union's Position

The Union proposes the following:

1. GS-12 bargaining unit employees to occupy private individual offices no less than 100 SF;
2. Bargaining-unit employees in grades AD 1 and GS 1-11 to occupy lockable individual cubicle workstations no smaller than 80 SF, with wall panels no lower than 72 inches
3. Each floor to have two break rooms (pantries) with microwave ovens, refrigerators, ice makers and sinks, which combined do not exceed 350 SF on any single floor;
4. No space to be devoted to vending machines, except those co-located with the cafeteria/bistro;
5. The size and capacity of floor-shared conference rooms to be determined after workspace is assigned, if space permits on any floor;
6. Team rooms to be allocated no more than one per division, if space permits after workspace is assigned. Team rooms to be reserved for bargaining-unit members; and
7. Floor storage and filing space to be permitted up to a maximum of 400 SF per floor, if space permits after workspace is assigned.

The Union contends, in essence, that 100 SF offices for GS-12 employees and cubicle workstations no smaller than 80 SF for employees in grades AD-1 and GS 1-11 would better accommodate the way employees perform the mission-critical work of the agency. The mission does not change merely because of a move to a new location. It maintains that the Employer's interior space plan is flawed because it does not recognize the realities of how employees perform their work. The Employer has proposed an excessive amount of space for collaborative groups even though an increasing number of meetings among employees within the agency, and among employees and persons outside the agency, are conducted "virtually." Fewer in-person meetings should translate into less space devoted to meeting rooms, both large and small. Currently, more than 30 percent of review panels are conducted without the need for in-person meetings, which demonstrates that the agency has broadly accepted conducting its business in such a manner. Virtual panels are most often conducted from the private office of a program director and monitored in the cubicle of an administrative professional who has been paired with a program director or specific directorate to support the evaluation of individual research proposals for which funding is sought. Mission critical space, therefore, is the individual workspace of the employee.

Staff members work independently of each other and join across organizational lines, as necessary, to support NSF-wide efforts or collaborate on specific proposals. Consequently, collaboration space should be integrated into individual workspace, and not placed outside of employee workspace. Requiring NSF staff to leave their workspace to go to a designated collaboration space is not an efficient way to perform agency business. Rather, individual workspace is collaboration space and it should be large enough to accommodate the meetings that take place within it. Additionally, GS-12 employees should be assigned to private offices consisting of 100 SF because most employees at that grade level currently have private offices pursuant to negotiated agreements between the Union and NSF. Also, the Union's proposal should be adopted because it would avoid disparate treatment of GS-12 employees who perform some of the duties, and have equivalent salaries as employees in pay banding grades AD 2 and 3, who are to have private office space.

The Union's proposed office and cubicle sizes would fit within the usable space of the new building had the Employer not over-estimated the number of offices and cubicles that would be

necessary to accommodate staff at the new location. In this regard, at various times management has factored into its design plan office space for a projected 10-percent growth in personnel, a percentage that is unrealistic and unfounded given that, while NSF's budget has risen steadily over the past 20 years, there has not been a corresponding rise in its personnel numbers. In addition to these "phantom" employees, management had planned office space for 400 contractor employees, a number that has not been justified or approved by the Office of Management and Budget.^{7/} There is a direct correlation between the Employer's unrealistic assessment of the office space it needs for current and future staff members and the Employer's proposal for small cubicles measuring 72 SF. The Union's proposal for 100 SF offices for GS-12 employees and 80 SF workstations for those at lower grade levels represent work space sizes that are likely to fit within available space if the Employer would reduce its estimate of the number of staff members who need workspace and reconsider the excessive amount of collaborative workspace it has proposed for the new facility.

The Union's proposals for lockable cubicles that are 6 inches higher than panel walls in current offices would provide employees with more security in their work space. Recent security breaches in Federal offices highlight the need for greater protective measures for employees should they have to "shelter in place"; the Union's proposals would serve that need. Partitions that are 72-inches high would afford more privacy during meetings that take place in employee workstations where members of the public often meet with employees to discuss confidential matters relating to funding for proposals.

Finally, with respect to space for break rooms, vending machines, floor-shared conference rooms, team rooms, storage and filing, the Union's proposals that, generally, would limit the size of those areas should be adopted because those spaces are not used for mission-critical work and, therefore, allotments for those spaces should give way to affording certain employees 100 SF private offices and 80 SF cubicle workstations as proposed by the Union.

7/ Ultimately, the Employer appears to have reduced both the percentage of its employee growth rate and the number of contractor employees it intends to seat within the new facility.

OPINION

Having carefully considered the arguments and evidence presented in this case, I conclude that the impasse should be resolved on the basis of a compromise solution which would place GS-12 employees in cubicle workstations, no less than 80/81 SF, with partitions of not less than 66 inches, except for the approximately 11 GS-12 employees now occupying private offices who would have partitions not less than 72 inches high. The remainder of the issues shall be resolved, for the most part, on the basis of a modified version of the Employer's final offers.

I am not persuaded by either the Union's argument that all GS-12 employees should occupy private office space of 100 SF or the Employer's position that they be relegated to cubicle workstations of no more than 72 SF. The record reveals that there are approximately 90 GS-12 employees; currently, 11 occupy private offices while others have cubicle space. Consistent treatment of all GS-12 employees is warranted in terms of the size of their work space and, in my view, they should be able to perform their duties in 80 to 81 SF workstations.^{8/} Furthermore, for those approximately 11 GS-12 employees who occupy private offices, I believe that their cubicle partitions should be no less than 72 inches high to better simulate the environment of private work space, which they now will have to sacrifice. I leave it to the Employer to determine how to accomplish the higher workstation panels for this group of employees.

For all other employees whose work space remains in dispute, the Employer's proposal for 72 SF workstations with 66-inch high partitions, provides the better alternative, given the concern that larger cubicle space may not fit within the Employer's plan which devotes more space in the new facility to conference rooms for panel meetings and, generally, more space in which employees may collaborate. Throughout the proceeding, the parties have presented different and sometimes changeable numbers with respect to how many offices and workstations are planned for the new facility. Those numbers appear to be different from those contained in the POR and those upon which the various architectural test fits were based and still different from data provided before, during and after the

^{8/} Resolution of this issue is consistent with the parties' agreement to have consistency in employee office/workstation sizes because GS-12 employees in all organizational entities are to be afforded workstations consisting of 80/81 SF.

mediation-arbitration proceeding. As a result, it is difficult to make a conclusive determination which of the parties' workstation proposals would fit within the available space. I note that the trend within the Government is to shrink the "foot print" for work space and, with that in mind, I have determined to adopt the proposal for a smaller workstation size of 72 SF as it is more likely to fit within the overall interior design plan for the new office. I shall not order locks for any cubicle partitions as the cost for having them seems high and there was not sufficient justification for lockable partitions presented by the Union.

With respect to the remaining issues concerning kitchenettes, refreshment centers, floor-shared meeting space, team rooms, and filing and storage space, I find that the Employer's proposals offer a balanced integration of those areas with employee office and cubicle space and, therefore, I shall order their adoption. I am persuaded that the Employer's need for collaborative work areas and space to maintain paper files, as well as space that enhances employee working conditions, are likely to better serve the interests of all of the parties. The Employer would place kitchenettes, refreshment centers, and space for filing and storage in areas that could not otherwise be used for employee offices or cubicles, which represents good space planning. I shall grant the Employer discretion, however, in determining the size and number of collaborative areas, filing and storage spaces, kitchenettes and refreshment centers because it may find it necessary to make adjustments to those areas in order to accomplish 80/81 SF cubicles for GS-12 employees.

DECISION

The following shall be incorporated into the parties' Memorandum of Understanding concerning the relocation of the Employer's office to the Alexandria, Virginia site:

1. GS-12 employees will occupy cubicle workstations, without lockable doors, no smaller than 80/81 SF. Partitions for their cubicles shall be no less than 66 inches high, except for the approximately 11 GS-12 employees currently occupying offices, and who shall occupy cubicles with partitions that are no less than 72 inches high.
2. All other bargaining-unit employees, whose cubicle size remains in dispute, will occupy cubicle

workstations without lockable doors, no smaller than 72 SF, with partitions no less than 66 inches high.

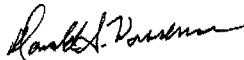
3. Each floor will have two shared kitchenettes, with microwave ovens, refrigerators, ice makers and a sink, provided that the kitchenettes are placed within space that could not otherwise be used for offices or cubicles.

4. There will be no more than five floor-shared refreshment centers with vending, and seating for no less than six persons, distributed on alternating floors, provided that the refreshment centers are placed within space that could not otherwise be used for offices or cubicles.

5. Floor-shared meeting space will be maintained at current design level, one per floor (20-40 person seating).

6. Team rooms will be allocated with no more than one per division; and

7. File space will be distributed according to the need of the organization and adjusted to the space available, provided that the filing areas are placed within space that could not otherwise be used for offices or cubicles.



Donald S. Wasserman
Arbitrator

October 23, 2014
Washington, D.C.

**UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Appropriations
Subcommittee on Commerce, Justice, Science, and Related Agencies
Hearing on
National Science Foundation FY 2016 Budget Request
March 17, 2015
Dr. France Córdova, Director, National Science Foundation
Questions for the Record Submitted by
John A. Culberson**

RELOCATION OF NSF HEADQUARTERS

The fiscal year 2016 budget request includes \$30.8 million, an increase of \$14 million, to support NSF headquarters relocation. Union negotiations have slowed the project and increased costs.

Question • Please provide a copy of the documents describing Union demands and those items being included in the final construction of the headquarters building.

Answer: Attachment 1 is the original Demand to Bargain, and Attachment 2 is the subsequent decision from the Federal Service Impasses Panel (FSIP). Note that the Union's Demand to Bargain addresses several issues in addition to topics directly related to the construction and design of the building; the FSIP decision addressed only those items that impacted the design of the internal space. The items included in the FSIP decision are being included in the final construction of the headquarters building; the additional negotiable issues will be resolved through discussions with the Union.

Question • Have the negotiations between NSF and the NFS union increased the overall cost of the program and slipped the schedule?

Answer: Negotiations between NSF and AFGE Local 3404 were a contributing factor to the slippage to the schedule. NSF is working on obtaining cost estimates and will provide additional information to the subcommittee as it becomes available.

Question • Does the fiscal year 2016 budget request reflect the increased costs as a result of union negotiations?

Answer: The fiscal year 2016 budget request was not changed from original projections, and does not include any increased costs stemming from the schedule slippage.

Question • Does the fiscal year 2016 budget reflect the final funding request to complete and fit out the new headquarters?

Answer: No, the fiscal year 2016 budget does not reflect the final funding request to complete and fit out the new headquarters. Additional funding will be required in FY 2017 and potentially in FY 2018 to complete and fit out the headquarters. NSF is working to obtain cost estimates and will provide additional information to the subcommittee as it becomes available.

QUESTIONABLE NSF GRANTS

Question: Please provide the Committee with an update on NSF efforts to strengthen accountability and the transparency of the grant-making process.

Answer: NSF has focused on two important activities in the past year:

- Ensuring NSF award abstracts and titles, the prominent public face of NSF's investments, clearly describe the award activity and justify the expenditure of federal funds; and
- Clarifying the roles and responsibilities of program officers and division directors in the merit review of grant proposals and the decision making on awards to ensure the integrity of the merit review process through transparency of process and accountability of organization with appropriate oversight at each level.

NSF looks forward to keeping the Committee informed of next steps in the continuous improvement cycle of implementation and assessment.

DESIGNATING AMOUNTS FOR EACH DISCIPLINE

Question: Currently, the Commerce, Justice, and Science appropriations Act does not designate specific funding amounts for each of the research disciplines within the Research and Related Activities account. How would designating funding amounts within the Research and Related Activities account impact NSF?

Answer: NSF's major concerns regarding the designation of funding amounts within the Research and Related Activities are 1) that it would undermine the cooperation across organizational units that is a defining characteristic of NSF's current budget development process; 2) that it would jeopardize the agency's flexibility to pursue promising, emerging opportunities; and 3) that it would minimize the value of input from the scientific community (such as through workshops and decadal surveys). The process would likely become highly politicized, and would lack a reliable mechanism for incorporating expert input from the science and engineering community.

The goal of NSF's process is to develop the portfolio of investments that best meets the needs of the Nation. That's a process that takes months of discussion. It engages the National Science Board, incorporates Administration guidance, and addresses requirements established in Congressional legislation. It reflects discussions of emerging areas of science and engineering with NSF's Advisory Committees. And, it draws on a wide array of inputs such as studies by the national academies and decadal surveys that set priorities for a discipline.

Moreover, the discussions among leadership within NSF are structured so that the directorates work together to identify and pursue the most important priorities and greatest challenges -- regardless of discipline. Of course, there is an element of competition involved, but the cooperation among the directorates, especially at the leadership level, is the defining characteristic of the process. This cooperation allows the NSF Director to present a budget motivated by what is best for the science and engineering enterprise.

Appropriating funds by directorate would undermine this cooperation, since it would energize competition among different disciplines. It would bypass the forums for discussions inherent in the current process and focus instead on lobbying key Congressional members and their staff.

In summary, NSF believes the current process, because it fosters cooperation across disciplines, provides flexibility to pursue emerging opportunities, and draws fully upon input from the community, best responds to the nation's needs and enables the agency to fulfill its responsibilities for strengthening U.S. science and engineering overall, in keeping with the NSF mission.

REPLICABILITY OF NSF RESEARCH

Question: Concerns have been raised about the replicability of some of the research funded by NSF. Last year, the House Appropriations Committee included language noting that the “gold standard of good science is the ability of a research lab to reproduce a method and finding and ... shares the concern that a significant amount of research cannot be easily reproduced.” What steps is NSF taking to address this matter?

Answer: Producing and disseminating scientific knowledge are at the heart of the research enterprise and are central to the mission of the National Science Foundation. To succeed in our mission, the Foundation is constructing and implementing a framework for fostering scientific “reliability” – the term used within NSF to encompass characteristics of published results in which others have confidence and on which they can build. Because different research practices are appropriate and effective in different scientific and engineering domains, any such framework must accommodate the substantial variety of research that NSF funds. While there are common themes such as clear presentation of methods, appropriate and rigorous statistical analyses, and long-term availability of data that contribute to the reliability of all research, constructing a useful framework requires a broad view of research results as more than observations and conclusions but also as data, calculations, analytic methods, and simulations along with the models and software on which they rest.

To further inform continued development and implementation of our framework for fostering scientific reliability, the Foundation is engaged in a wide-ranging examination of issues related to scientific reliability both internally and in consultation with our scientific communities. All of the NSF directorates are examining the nuances of reliability relevant to their scientific disciplines, and all have had specific agenda items on the topic during their respective Advisory Committee meetings in the past year. Several directorates have sponsored workshops on the topic to hear from a broad range of stakeholders in the research enterprise, including investigators, other federal agencies, business and industry, private foundations, journal editors, and professional societies.

In addition, the Foundation is convening a symposium, tentatively entitled *Robust and Reliable Science— the Path Forward*. Tentatively scheduled for late summer or early fall at NSF, this event will feature invited speakers and parallel breakout sessions to discuss potential NSF activities to address scientific reliability.

These activities are ongoing and are expected to inform an agenda that deepens our knowledge about factors that compromise scientific reliability and guides our efforts to improve it in NSF-funded work. An internal working group will be tasked with proposing NSF policy and practice changes to improve scientific reliability in NSF-funded work. Possibilities include strengthening the agency's guidelines for data management plans and the reporting requirements for the research we fund. Ensuring reliability of scientific findings rests on efforts from all corners of the

research enterprise and therefore NSF will continue to operate in a transparent fashion, inviting input on its activities from staff across the Foundation and the external scientific communities that we serve.

ETHICAL CONDUCT OF RESEARCHERS

Question: The IG's management challenges report cites encouraging the ethical conduct of researchers as one of NSF's management challenges. In response to the America COMPETES Act in 2007, NSF mandated mentoring programs and training and oversight over student and postdoctoral researchers. The IG reported that even with these programs, the IG "continues to receive substantive data fabrication/falsification allegations involving students, post-docs, and faculty." How does NSF plan to ensure that awardees implement effective Responsible Conduct of Research programs?

Answer: The responsible and ethical conduct of research (RCR) is critical for excellence, as well as public trust, in science and engineering. Consequently, education in RCR is considered essential in the preparation of future scientists and engineers. Section 7009 of the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Act (42 U.S.C. 1862o-1) requires that "each institution that applies for financial assistance from the Foundation for science and engineering research or education describe in its grant proposal a plan to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduate students, graduate students, and postdoctoral researchers participating in the proposed research project."

An institution applying for NSF funds must have a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students, and postdoctoral researchers who will be supported by NSF to conduct research. Training plans are subject to NSF review, upon request.

An institution must designate one or more persons to oversee compliance with the RCR training requirement, and institutions are responsible for verifying that undergraduate students, graduate students, and postdoctoral researchers supported by NSF to conduct research have received training in the responsible and ethical conduct of research.

In developing the Foundation's RCR policy, NSF relied greatly on the external community's feedback and involvement. Specific activities included:

- NSF published its implementation plan in the Federal Register and provided an opportunity for the community to weigh in on its approach;
- An NSF-funded workshop entitled "Ethics Education: What's Been Learned? What Should be Done?" was held by the National Academies of Science & Engineering; and
- NSF created an RCR website that contains links to ethics-focused NSF-funded resources.

NSF's implementation of the RCR requirement is consistent with its mission and with its approach to supporting research at the cutting edge of science. With each proposal, institutions must certify that they have an RCR plan in place, the plan is subject to review by NSF upon request, and the institution is afforded the flexibility to tailor each plan to the project being proposed as well as the students and postdoctoral researchers being trained. NSF believes that the research community, encompassing both individual researchers and institutions, is best placed to determine the content of RCR training without a need for NSF-specified standards. Furthermore, NSF recognizes that specific training needs may vary depending on specific

circumstances of research or the specific needs of students intending to pursue careers in basic or applied science after completing their education. Therefore, it is the responsibility of each institution to determine both the content and the delivery method for the training that will meet the institution's specific needs for RCR training in all areas at that institution for which NSF provides support.

In addition, all NSF directorates participate in Cultivating Cultures for Ethical STEM (CCE STEM), a program that funds research projects that identify factors that affect the formation of ethical STEM researchers in all the fields of science and engineering that NSF supports. CCE STEM research projects will use basic research to produce knowledge about what constitutes responsible or irresponsible, just or unjust scientific practices and sociotechnical systems, and how to best instill students with this knowledge. Results of the CCE STEM program will contribute to resources that institutions may utilize in complying with Sec 7009 of the America COMPETES Act (H.R. 2272). Additional information about the CCE STEM program can be found at www.nsf.gov/funding/pgm_summ.jsp?pins_id=505027.

INFRASTRUCTURE

Question: The National Academy of Science published its 2015 Ocean Studies Board Decadal which found that the cost of NSF infrastructure is crowding out research funding. How is NSF going to address the concerns outlined in that report? The Academy recommended that NSF cut infrastructure costs immediately by 10%. Does NSF intend to adopt that recommendation?

Answer: NSF has carefully evaluated the National Academy of Science's (NAS) report and engaged multiple aspects of the community to gauge reaction to the report's recommendations. Community response to date has been generally supportive of the recommendations. Prior to the release of the NAS report, NSF began rebalancing support of ocean sciences research and infrastructure, and over the coming year intends to continue to shift support in favor of research to achieve the realignment recommended by the NAS.

ANTARCTIC PROGRAM

Question: The latest IG top management challenges report highlighted issues with containing costs for the Antarctic Support Contract awarded by NSF in December 2011 – a cost reimbursement contract valued at about \$1.925 billion over 13 years. How does NSF plan to manage this risk and control the costs from this contract? How does NSF plan to make an objective evaluation of contractors' performance to inform the decision of whether or not to give a contractor an award fee?

Answer: Because NSF has adopted a cost-reimbursable-award-fee type contract to support and maintain its stations in Antarctica, its contract management process is far more efficient than had the Foundation elected to transfer the cost risk to the contractor through a fixed-price contract. Under a fixed-price contract, NSF would likely have had to pay three times the award fee pool in order to compensate a contractor to assume cost risks under a fixed-price contract. Additionally, NSF would have been severely disadvantaged in negotiating all of the contract modifications and change orders that would result from operating in the remote and inherently uncertain Antarctic environment.

Prior to awarding the support contract, the Defense Contract Audit Agency performed pre-award audits. In addition, the contractor has Defense Contract Management Agency (DCMA)-

approved business systems. Since award, NSF has initiated several activities to manage the costs under this cost reimbursement multi-year contract. There is close coordination between the contractor, the NSF program office (Directorate for Geosciences/Division of Polar Programs (PLR)), and the contracting officer (Office of Budget, Finance, and Award Management/Division of Acquisition and Cooperative Support (DACS)) during the annual planning and budget approval process, which results in a not-to-exceed Annual Program Plan (APP). Once the APP is approved, there is a change review process that includes a Change Review Board (CRB), proposed task change summaries, updated financial analysis data (that includes cost variance of anything greater than \$25,000), and a cost summary log. The process is followed for scheduled monthly meetings as well as for out-of-cycle requests. Increases in cost (for example, from higher DCMA-negotiated overhead rates) are offset by reductions in contract scope.

In addition, invoices are thoroughly reviewed by PLR and DACS to ensure accuracy and appropriateness of the direct and indirect charges. Audits have been and will continue to be performed with appropriate follow-up on any findings. Far from cost overruns, the USAP has a history of supporting growing science with little or no real cost growth over the past two operations and maintenance (O&M) contracts.

With respect to the evaluation of contractors' performance the decision of whether or not to give the contractor an award fee is, by law, an inherently governmental activity. Furthermore, it is imperative that those with direct knowledge of the contractor's performance throughout the year be involved. Ultimately, the final evaluation and determination of the contractor's award fee is made by the Award Fee Determination Official (FDO), who should be separate from the officials involved in the day-to-day management of the contract. Optimally, a senior executive who is not involved in the daily execution of the program, but has substantive knowledge of the program objectives should be designated FDO. In the case of the Antarctic Support Contract, the FDO is the Director of Polar Programs, who is not directly involved in the day-to-day management of the Antarctic Infrastructure and Logistics program and contract.

As provided under Federal Acquisition Regulations, the awarded contract includes an Award Fee Plan that identifies, at a minimum, the details of the process elements (such as desired technical or cost outcomes), performance scoring, fee calculation, and payment terms. This plan ensures that there is a robust and systematic assessment of the contractor's performance. At the end of the extensive, multi-level review process, the FDO submits the determination to the contracting officer who, if there is agreement, will modify the contract to permit payment of the fee.

Question: In July 2012, a Blue Ribbon panel issued its report that included recommendations and 84 implementing actions regarding NSF's Antarctic Program. What changes has NSF begun to implement in response to that report?

Answer: The NSF Director and the Chair of the National Science Board published an initial response to the Blue Ribbon Panel (BRP) report in March of 2013¹. In support of the response, NSF prepared a point-by-point summary of how it was implementing and tracking the 84 actions arising out of the BRP recommendations. To date, 71 of the 84 actions have been resolved. Among implemented changes, NSF has revised medical screening criteria for physical qualification examinations to better align with modern standards, and has improved the process of matching medical requirements to the task, location, and risk of each deploying individual. Additionally, NSF has revised and updated on-site safety procedures, policies, communication

¹ https://www.nsf.gov/geo/plr/usap_special_review/usap_brp/rpt/nsf_brp_response.pdf

strategies, and training tools to reduce risks for all personnel while deployed. Other changes include upgrades in information technology to enhance critical data collection from scientific instrumentation, addition of a small boat dock and ramp at Palmer Station to improve the safety of small boat operations, and upgrades of fire system controls at all stations.

To address recommended large-scale changes in key Antarctic infrastructure, NSF is developing the Antarctic Infrastructure Modernization for Science (AIMS) project, which is in an early planning stage. AIMS would develop the major BRP recommendations into a full-scale upgrade of Antarctic infrastructure for consideration under NSF's Major Research Equipment and Facilities Construction (MREFC) Account. Actions that could be addressed through AIMS include replacement of the Palmer Station pier to ensure long-term access for resupply and research; comprehensive redevelopment of McMurdo Station into a smaller and more energy and operationally efficient facility optimized for support of local and remote field science; and replacement of the major McMurdo Station logistics facilities, to include the mobile runway and vessel operations support structures. By increasing the efficiency of Antarctic operations, implementation of AIMS would enable NSF to contain operations and maintenance costs and ensure flexible and robust support of Antarctic science into the coming decades.

EUROPA

Question: Much promise exists in a mission to Europa. What research is NSF conducting in Antarctica that will support the NASA mission to Europa? How does NSF ensure that the research it conducts in this area is made available to NASA?

Answer: Europa, thought to have an ocean beneath its ice surface, is one of many sites in our Solar System for which the Antarctic can be a useful analog. NSF and NASA have a long history of partnering in Antarctica on activities related to planetary exploration, both for understanding processes and for development of instrumentation that might be used to explore planetary environments.

NSF and NASA actively partner by reviewing and co-sponsoring research and workshops on subjects of mutual interest, including activities related to a NASA mission to Europa. Some examples include:

- Joint support of workshops as a mechanism for sharing information on the connections between Antarctic research and planetary analogs;
- Cooperation on proposals, such as joint consideration for support between USAP Antarctic Sciences programs and NASA's Astrobiology Science and Technology for Exploration of the Planets (ASTEP) Program; and
- NSF support of NASA's Sub-ice Investigation of Marine and Planetary-analog Ecosystems (SIMPLE) project, which is developing technology for potential use on icy moons like Europa.

Other NSF-sponsored activities with implications for Europa include NSF's cooperation with the German space agency on the Minimally Invasive Direct Glacial Exploration (MIDGE) project, which funds development of technologies for exploration of Europa-like planets. Additionally, some technologies developed and employed for NSF-supported sub-ice sheet exploration activities are relevant to exploration of icy moons like Europa because they focus on approaches to sampling sub-ice sheet environments.

NSF requires grantees to provide meta-data about instrument development, observations, and research findings to the Antarctic Master Directory, a cooperative venture promoted under the auspices of the Antarctic Treaty through the International Council for Science (ICSU) activity called the Scientific Committee on Antarctic Research (SCAR). Information in the Antarctic Master Directory makes project information easily discoverable. The Antarctic Master Directory is hosted by NASA's Global Change Master Directory. NSF requires publication of research results in the open refereed literature, and also requires public release of all data. Open data sharing is a stipulation of the Antarctic Treaty, and normally research data must be released no later than two years after collection.

LARGE SYNOPTIC SURVEY TELESCOPE

Question: NSF is requesting \$100 million to continue building the Large Synoptic Survey Telescope. In September 2014, the NSF IG issued an alert memo expressing "strong" concern that NSF did not have sufficient information to establish a reasonable basis for the cost of the project. What steps is NSF taking to address the problems highlighted by the IG?

Answer: NSF has developed a Corrective Action Plan (CAP) to address recommendations set forth in the OIG Alert Memo, *NSF's Management of Costs Proposed for the Large Synoptic Survey Telescope Construction Project* (OIG Report, 14-3-002), and it is summarized below.

Regarding OIG concerns over the sufficiency of information for the Large Synoptic Survey Telescope (LSST) project cost, it is NSF's position that, prior to award of the LSST cooperative agreement, the agency had conducted sufficient analysis to establish a reasonable basis for the estimated project cost. This analysis was thoroughly documented through a Cost Proposal Review Document (CPRD) that addressed the grants and agreements officer's analysis of the acceptability of all elements of proposed costs and that included reductions to proposed costs. NSF did identify two cost elements where insufficient information was available prior to award to determine the reasonableness of associated costs. In these situations NSF deferred finalization of estimates pending further review and negotiation.

The OIG Alert Memo referenced previous OIG recommendations that NSF obtain proposal and accounting system audits for high-risk cooperative agreements in excess of \$50 million, and that NSF obtain incurred cost submissions and audits of these large awards. These recommendations, discussed in the "Background Section" of the Alert Memo, were based on examination of awardee proposed costs under three large NSF projects (the Ocean Observatories Initiative, Advanced Technology Solar Telescope (name changed to Daniel K. Inouye Solar Telescope), and National Ecological Observatory Network). We note that these OIG recommendations, which were escalated to the NSF Audit Follow-up Official on May 22, 2014, have been resolved through a decision by that official executed on January 13, 2015. That decision established a threshold of \$100 million for obtaining accounting system audits in those cases where NSF is the cognizant agency and where such audits have not been performed within the past two years. The decision of the NSF Audit Follow-up Official also upheld NSF's position that the need for a proposal audit be reviewed on a case-by-case basis, not at a specific dollar threshold. Requirements for incurred cost submissions and incurred costs audits were also resolved as detailed in the decision. Related to the LSST award, we note that the grants and agreements officer specifically addressed accounting system adequacy in the CPRD analysis, stating that for the awardee, Association of Universities for Research in Astronomy (AURA), the accounting system was determined to be adequate based on several criteria. This was supported by a follow-up Defense Contract Audit Agency (DCAA) accounting

system audit performed in 2013 that found AURA had developed procedures to resolve prior identified accounting system deficiencies.

The Alert Memo discussed an internal review of the AURA project budget completed in June 2013 by the Cost Analysis and Audit Resolution (CAAR) Branch within NSF's Division of Institution and Award Support, and it relates that the review could not independently verify costs for any of the 136 proposed expenditures sampled. However, the Alert Memo does not relate that the CAAR review was conducted at the Preliminary Design Review stage and based on a preliminary cost estimate developed while the project was still in formulation. The estimate was subsequently replaced by an updated and detailed cost estimate at the Final Design Review stage, when more definitive information was available on project requirements and schedule. It was this subsequent cost estimate that was used by the grants and agreements officer and by CAAR to evaluate costs for establishing the total estimated cost of the cooperative agreement. As part of this final review, and as committed to by the agency prior to its conduct, major cost issues set forth in the initial CAAR report were addressed prior to making the award. These cost issues included those identified in the OIG Alert Memo (pages 4 - 5) under the heading of "Cost Estimates and the LSST Project."

Furthermore, to address the OIG Alert Memo recommendations and its three parts in consecutive order:

First, NSF believes that its analytical efforts as detailed in the agency's CAP have been sufficient to determine that the estimated costs of the LSST project are both reasonable and realistic. These efforts included successfully passing through the three design gateways, two independent cost reviews, and two internal cost analyses. The OIG recommended that funding of LSST be suspended pending re-evaluation of costs by the agency. It is quite possible that any delay owing to the suspension of work necessary to implement this recommendation would have resulted in cost increases above and beyond the results (if any) of the subsequent negotiations given the on-going site preparation and component manufacturing activities. Given the aforementioned assurances of its own extensive cost analysis, NSF found the recommendation to suspend neither prudent nor warranted.

Second, additional audit work on AURA's accounting systems was completed in 2013. Considering the satisfactory results of the audit, limited elapsed time since its completion, and significant competition for NSF resources, NSF concluded that little benefit would be gained from repeating work so recently accomplished. Similarly, AURA's estimating system was examined as part of NSF's Business System Review (BSR) program in 2012 and found to be sufficient. The BSR examinations are conducted on a continuous five-year cycle and AURA will be reviewed again in 2017.

Finally, NSF's Corrective Action Plan to the OIG Alert Memo outlines NSF's approach to cost surveillance and the use of additional audits. NSF will ensure that it documents the results of the required analysis and the need for any additional audit services. At a minimum, an audit will be conducted following project completion.

DANIEL K. INOUE SOLAR TELESCOPE

Question: The NSF Inspector General has raised concerns about the lack of documentation for the cost estimates for construction of the Daniel K. Inouye Solar Telescope. How is NSF ensuring that funds are spent appropriately?

Answer: NSF is in the process of resolving issues raised in NSF Inspector General Audit Report No. 14-1-005 and anticipates that audit resolution will be completed by June 30, 2015. NSF has completed a reasonableness evaluation of the re-baselined cost proposal for the Daniel K. Inouye Solar Telescope that includes an analysis of re-estimate costs, including review of individual cost elements. Based on the analysis conducted to date, NSF has determined there is no evidence of any unreasonable costs included in the re-baselined proposal and will make a final determination of reasonableness after completing resolution of the OIG audit recommendations. Any determination of unreasonable costs that may be made based on final resolution of the OIG audit recommendations will result in re-negotiation of the cost proposal to exclude such costs.

On a monthly basis, NSF is monitoring project expenditures. As part of the award requirements, the awardee is required to submit monthly reports that document expenditures, milestones, earned value management, contingency management, risk management, and other relevant issues.

Question: What actions has NSF taken to strengthen accountability of its high-dollar, high-risk cooperative agreements for large facility construction projects in general?

Answer: NSF has taken numerous actions to strengthen accountability of its high-dollar, high-risk cooperative agreements for large facility construction projects. In June 2014, NSF implemented new procedures for the analysis of awardee cost proposals that requires increased documentation of the analysis of cost estimates through the execution of a Cost Proposal Review Document (CPRD) that fully addresses how each element of cost was determined by the agency to be reasonable, and requires that an independent cost assessment performed by personnel outside of NSF be obtained. NSF simultaneously implemented new procedures requiring that a thorough analysis of the need for incurred cost audits during project performance be completed on a regular basis, and that at a minimum an incurred cost audit be obtained at project completion. NSF will also obtain audits of awardees' accounting systems/practices prior to entering into any large facility construction cooperative agreement totaling \$100 million or more, in those cases where NSF is the cognizant agency and where such an audit has not been performed within the past two years. In addition, NSF has strengthened the requirements in the Large Facilities Manual for prospective large facility awardees to provide adequate documentation of risk at gateway reviews and throughout the project. These requirements and the requirement for an independent cost review are designed to give NSF management sufficient confidence in the total project cost. Additional policy has been published to strengthen agency procedures for establishing and managing contingency estimates, and additional actions have been taken to ensure proper oversight of contingency, including a review of project change control procedures and threshold and the requirement that decisions on the use of contingency be fully documented and traceable to the project's risk register and work breakdown structure. Additional strengthened procedures are currently being developed, including providing awardees with more thorough guidance on the preparation of cost proposal information, including necessary supporting documentation for cost estimates. The agency will also complete an analysis of cost reporting requirements for large facility projects to result in recommendations for cost information submissions during performance.

DUPLICATION

Question: NOAA's DSCOVR satellite launched in February 2015 – its mission is to watch the sun and provide warning for solar storms that may impact Earth. The Daniel K. Inouye Solar Telescope will also be looking at the sun. How is this asset going to be different from the Mauna Loa Solar Observatory? How does NSF coordinate with other Federal agencies to avoid duplication?

Answer: When completed in 2019, the Daniel K. Inouye Solar Telescope (DKIST) will be the world's most powerful solar telescope, poised to answer fundamental questions in solar physics. DKIST is specifically designed to observe the Sun with unprecedented accuracy over a time period of more than two complete solar cycles (44 years), with a prime mission lifetime of 50 years. The long-term research goal of DKIST is distinct from the short-term space-weather prediction mission of the DSCOVR satellite. DKIST will provide major advancements in spatial resolution, sensitivity, and spectral coverage over current ground-based and space-based assets. The unique characteristics of DKIST include an off-axis, 4-meter primary mirror together with advanced adaptive optics, which provide diffraction-limited imaging resolution of 20 - 30 kilometers on the surface of the Sun. DKIST will use this resolution and sensitivity to study the detailed small-scale physics, particularly the magnetic structures, of the Sun from the photosphere to the outer corona. Much smaller ground-based telescopes (e.g., Mauna Loa Solar Observatory) do not have the resolving power of DKIST and are more suited to full-disk monitoring of the Sun. The magnetic phenomena that DKIST will study ultimately give rise to energetic solar events and to space weather, both of which are of critical importance to our technological society on Earth.

NSF coordinates with other federal agencies (e.g., NOAA, NASA, and USAF) on its solar physics and space weather programs through informal discussions and via formal channels such as the National Science and Technology Council's Space Weather Operations, Research, and Mitigation (SWORM) interagency task force and its predecessor, the National Space Weather Program (NSWP). NSF also participates in coordinated agency updates to the solar community through presentations made to entities such as the National Research Council's Committee on Solar and Space Physics (CSSP) and at agency town halls such as those of the American Geophysical Union and the American Astronomical Society Solar Physics Division.

**Questions for the Record Submitted by
Robert B. Aderholt**

GLOBAL CLIMATE MODELING

Question 1: The evidence is clear that the expensive global climate modeling effort supported in your budget has yet to reproduce the actual observations of the deep atmosphere of the last 3+ decades. This is the part of the atmosphere that is most affected by greenhouse gases so it needs to be done correctly. Are you willing to support independent research for those unaffiliated and even critical of the modeling industry to investigate these shortcomings on behalf of the American people? If you believe you have already done so, please provide a comprehensive list of grants awarded in the last five fiscal years which fit that description. This is vital because tens of thousands of jobs are being lost based on model projections shown here which to anyone's eye are invalidated by real observations.

Answer: NSF supports basic research that contributes to our knowledge, understanding, and predictability of the Earth's climate system through study of fundamental drivers that impact climate variability. Much of this work considers discrepancies between climate model projections and the observed climate record, including searching for physical processes or factors that explain why models and observations may not completely agree. NSF requires funded researchers to make model output accessible to other researchers who may wish to undertake independent analyses.

Any researcher with the capability to responsibly manage federal funds can submit proposals for consideration for funding. Research proposals are assessed using NSF's long-standing process of merit review, which utilizes external experts as reviewers.

EPSCOR

Question As you know, I come from a state that participates in the EPSCOR program, which means we receive a limited amount of NSF funding. This has, of course, been true for many years. So, my question is: what can NSF do on a more proactive basis to make sure states such as mine have an opportunity to apply to participate more fully both in on-going activities and in new initiatives?

Answer: Alabama became eligible for NSF EPSCoR funding in 1985. Since participating in the program, Alabama's share on NSF research funds has increased from 0.26 percent to 0.49 percent or an improvement of 88 percent. In addition, over the past five years, Alabama has been awarded approximately \$48 million from NSF through awards from the research directorates and co-funding from EPSCoR, which seeks to ensure fuller participation of Alabama's researchers and educators in NSF activities and new initiatives. The NSF EPSCoR program has been instrumental in catalyzing the engagement of Alabama's researchers and educators in NSF programs; however, additional actions that could continue to contribute to Alabama's progress include:

- Researchers should actively peruse the NSF website for information on NSF strategic priorities and funding opportunities.

- NSF EPSCoR routinely disseminates information of funding opportunities to the EPSCoR community via the state's project director and/or webinars. Individuals should take full advantage of these items.
- In FY 2014, approximately 650 proposal were submitted to NSF from Alabama; however, the success rate was approximately 15 percent compared to approximately 23 percent for NSF overall. Proposers are strongly encouraged to review the feedback on declined actions and revise and resubmit to future competitions. In addition, serving on merit review panels provides insight on what constitutes a meritorious proposal and this could be useful as future proposals are developed by individuals from Alabama.
- Individuals should take advantage of NSF EPSCoR's outreach mechanism, which supports outreach travel that enables NSF staff to directly engage and inform the EPSCoR research community about NSF opportunities, priorities, programs, and policies.
- Individuals should not hesitate to reach out to NSF program officers to obtain further clarification of program solicitations and/or funding opportunities.

Following through on these items as well as other items locally to strengthen sponsored research offices at institutions across Alabama could lead to increased participation in NSF opportunities.

**Questions for the Record Submitted by
Nita M. Lowey**

GEOSCIENCES

Question 1: Last year this subcommittee emphasized support for all of the NSF hard sciences except for the geosciences (ocean, earth and atmospheric sciences) -- an action that brings up the need to provide balanced support across fields of science. How do you see the geosciences contributing to our economic competitiveness and safety and security challenges?

The geosciences make important contributions to the Nation's economic competitiveness, the safety and well-being of the citizenry, and national security. NSF doesn't conduct research, instead funding research at universities and colleges across the US. NSF's approach is to tap into the "collective brilliance" of the university community throughout the Nation to tackle difficult research problems. A few specific areas where the geosciences make important national contributions include:

- Understand and predict natural disasters including earthquakes, volcanoes, tornados, hurricanes, tsunamis, floods, drought, and landslides, saving countless lives and billions of dollars in property damage.
- Better predict weather, such as improved forecasting of weather and warning systems.
- Understand mineral resource potential, production, and consumption, such as rare earth elements, which are vital to supporting the Nation's economy and security.
- Meet the Nation's water supply needs, which are critical for agriculture, energy, and industry, as well as human consumption.
- Assess the availability of unconventional resources, like shale gas and oil, which are among the fastest growing energy sources in the Nation.
- Collect Antarctic meteorites in collaboration with NASA to discover more about the development of the early solar system.
- Explore the deep dark biosphere below the sea floor, which may be an analog for life on other planets and help NASA design exploratory missions to other bodies in the solar system.
- Develop the workforce and the next generation of scientific leaders.
- Provide good paying jobs. In fact, mean salaries for geoscientists continue to increase in all major industries. Petroleum engineers (a geoscientist category) make the most money per year at nearly \$150,000 on average; geoscientists are making a mean annual salary of over \$106,000; mining and geological engineers are making a mean annual salary of over \$91,000; and hydrologists are making a mean annual salary of nearly \$79,000, to name a few occupations. (Source: *AGI Status of the Geoscience Workforce 2014*)

The discovery of bacteria living on rocks revealed how patients develop deadly blood infections from implanted cardiac devices. Geoscientists are studying these bacteria to inform the development of medications to prevent such infections. Annually, about 40,000 patients who have received implants develop infections. Infected devices must be removed and replaced, costing the U.S. nearly \$1 billion.

Also related to human health, NSF-funded research on the Antarctic icefish has revealed novel genes involved in red blood cell formation that might be developed as new targets for anemia treatments.

NSF-funded research relevant to the ocean sciences contributes to areas of national importance. For example, research on sea level change, one of the eight priority science questions identified in the National Research Council's 2015-2025 Decadal Survey of Ocean Sciences (*Sea Change*) report, has major significance for national security.

Related to national security, geoscience investments in understanding, modeling, and observing the coupled space weather system are building toward predictive models to forecast and mitigate potentially catastrophic events. Rare violent storms on the Sun have the potential to knock out large areas of the electrical power grid -- possibly for months.

DECADAL SURVEY OF OCEAN SCIENCES 2015

Question 2: The new report from the National Academy of Sciences on ocean science priorities for the next decade (exec summary attached), makes some hard hitting recommendations to scale back support for the academic fleet and other large infrastructure ocean research programs. This infrastructure is something we -- the Congress and this subcommittee in particular -- have made serious investments in over time -- largely at the urging of the science community. Just as some of this infrastructure (i.e. ocean observing initiative) is coming on line, the NAS is recommending we scale back the support for its operations. I realize this report has only come out since the end of January, nevertheless, how does NSF and the Board view this report and its recommendations?

Answer: NSF has carefully evaluated the National Academy of Science's (NAS) report and engaged the community to gauge reaction to the report's recommendations. Community response to date has been generally supportive of the recommendations. Prior to the release of the NAS report, NSF began rebalancing support of ocean sciences research and infrastructure, and over the coming year intends to continue to shift support in favor of research to achieve the realignment recommended by the NAS.

NSF is grateful for the continuing support of the Subcommittee and recognizes that significant resources have been invested in state-of-the-art infrastructure in support of research across a wide spectrum of fields including the ocean sciences. The overall strategy for increasing research support in the ocean sciences includes full deployment and operation of the Ocean Observatories Initiative (OOI) this year. According to previously approved plans, the OOI operations award will be recompeteted for FY 2017. As part of the recompetition process, dialog with the OOI research community will continue and will be informed by early operation of the facility. In this context, the operation and maintenance can be restructured and streamlined to reduce costs.

**Questions for the Record Submitted by
Jose E. Serrano**

ARECIBO OBSERVATORY

Question 1: The Arecibo Observatory is the world's largest single-dish radio-wavelength reflector and has been in service since 1963. Although multiple agencies perform research at the Arecibo Observatory, NSF's Division of Astronomical Sciences has the long standing responsibility for basic site maintenance and upkeep. Why has MPS/AST unilaterally deferred essential site and telescope maintenance? What is the timeline to fully remediate the earthquake damage and provide the much-needed maintenance to the telescope?

Answer: National Science Foundation funding for the Arecibo Observatory was reduced in the late 2000s and early 2010s as a direct response to the community recommendations of the NSF Senior Review Committee, which gave the Observatory low scientific priority relative to other astronomical facilities operated by NSF. In view of this lower priority and the age of the Arecibo dish, at greater than 50 years, NSF is not investing in long-term enhancements to the telescope at this time.

Regarding the 6.4 magnitude earthquake centered 60 km off the north shore of Puerto Rico that occurred on January 13, 2014, the only significant harm to the Arecibo Observatory was partial damage to one of the eighteen cables that run from the three support towers to the Arecibo platform. Each of the three towers has six such structural support cables. An independent engineering assessment of this cable and the platform support was carried out after the earthquake by a firm having considerable experience with the Observatory. In conjunction with the Arecibo staff, this firm designed a cable repair that was carried out by observatory staff, in consultation with the independent firm. The repair was completed, certified, and the telescope returned to full service on March 11, 2014.

Question 2: What are NSF's plans with regard to the Arecibo Observatory after the current contract expires in 2016? Will NSF work with NASA to ensure that the facility stays in operation?

Answer: The Portfolio Review carried out in 2012 by the NSF Division of Astronomical Sciences (AST) in the Directorate for Mathematical and Physical Sciences advised AST to reconsider its participation in Arecibo Observatory later in the (current) decade. AST partners with the NSF Division of Atmospheric and Geospace Sciences (AGS) in the Directorate for Geosciences. The Geospace section of AGS is presently conducting a portfolio review. Among the issues that will be covered is analysis of the balance between research grants and infrastructure costs, with associated prioritization of science needs and the connected infrastructure requirements. Thus, discussion of the disposition of assets within the portfolio in AGS (which shares investment in Arecibo with AST) awaits the outcome of the Geospace section portfolio review. Additionally, NSF is in ongoing discussion with NASA about the future priority for Arecibo Observatory; any decisions about the future of Arecibo will be made as a result of the community prioritization activities and interagency consultations.

HISPANIC-SERVING INSTITUTIONS

Question 1: Although NSF has recognized the importance of minority participation, it has failed to create a program for Hispanic-serving institutions (HSIs) despite repeated direction from Congress to use the authority granted to do so under the America COMPETES Act. The absence of such a program reduces the likelihood of Hispanic students seeking a STEM education and perpetuates the underrepresentation of Hispanics in this field.

After this Committee has provided clear instructions in numerous occasions, why does NSF continue to refuse to establish an HSI program? Does NSF intend to establish such a program in the near future?

Answer: NSF recognizes that Hispanics are the largest and fastest-growing minority group in the Nation. In FY 2014, NSF funds awarded to Hispanic Serving Institutions (HSIs) totaled approximately \$207 million through 432 awards. Given this significant level of investment, NSF plans to continue activities that are successfully meeting the needs of HSIs, including encouraging HSIs to submit proposals to appropriate, existing NSF programs that focus on improving undergraduate education and/or express a commitment to broadening participation of groups underrepresented in STEM. In 2013 – 2014, 409 institutions were categorized as HSIs (defined as institutions with 25 percent or more total undergraduate Hispanic full-time equivalent student enrollment); these included small community colleges, four-year primarily undergraduate institutions, and large research-intensive universities, all with different missions. The range of available STEM programs within this array of institutions is quite broad. Crafting a single program which has the potential for national scale and serves such a variety of institutions presents a logistical, programmatic, and financial challenge, particularly as the number of HSIs is increasing rapidly.

In FY 2015 and FY 2016, the Directorate for Education and Human Resources (EHR) will focus on Hispanic-serving two-year institutions through partnerships with programs such as Advanced Technological Education (ATE), Improving Undergraduate STEM Education (IUSE), and Louis Stokes Alliances for Minority Participation (LSAMP). Additionally, EHR released a Dear Colleague Letter calling for proposals: *Announcement of Effort to Broaden the Participation of Students in Two-Year Hispanic Serving Institutions in Science, Technology, Engineering, and Mathematics (STEM)* (NSF 15-063). Proposers may request supplemental funding 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.

THURSDAY, MARCH 26, 2015.

**OVERSIGHT HEARING—FEDERAL INVESTMENTS IN
NEUROSCIENCE AND NEUROTECHNOLOGY**

WITNESSES

**JO HANDELSMAN, PH.D., ASSOCIATE DIRECTOR FOR SCIENCE, OFFICE
OF SCIENCE AND TECHNOLOGY POLICY**

**JAMES OLDS, PH.D., ASSISTANT DIRECTOR FOR BIOLOGICAL
SCIENCES, NATIONAL SCIENCE FOUNDATION**

**STEVEN HYMAN, M.D., DIRECTOR, STANLEY CENTER FOR PSYCHO-
LOGICAL RESEARCH BROAD INSTITUTE OF MIT AND HARVARD**

**ZACK LYNCH, EXECUTIVE DIRECTOR, NEUROTECHNOLOGY INDUSTRY
ORGANIZATION**

Mr. CULBERSON. The Commerce, Justice, Science Appropriations Subcommittee will come to order.

I want to welcome everyone to this morning's hearing to discuss Federal investments in neuroscience and neurotechnology. Our ranking member, Mr. Fattah, has been a champion in Congress on this very important issue for many years. It has been my privilege to work with Mr. Fattah, my predecessor Frank Wolf on this very important topic, and I thank him for encouraging us to have this hearing today.

I would like to welcome our witnesses this morning, Dr. Jo Handelsman, associate director for science at the Office of Science and Technology Policy. We are delighted to have you with us here this morning, Dr. Handelsman, thank you. And Dr. James Olds, the assistant director for biological sciences at the National Science Foundation; and Zack Lynch, executive director of the Neurotechnology Industry Organization; and Dr. Steven Hyman, director of the Stanley Center for Psychiatric Research at the Broad Institute of MIT and Harvard.

I look forward to your testimony on this vitally important and emerging field with exiting new developments taking place all the time, and I thank you sincerely, Mr. Fattah, for helping put this together and making this possible and keeping the focus of this committee on this cutting-edge and extraordinarily important research, and I am looking forward to—

Mr. FATTAH. Thank you.

Mr. CULBERSON [continuing]. Your remarks, sir.

Mr. FATTAH. Well, thank you, Mr. Chairman.

Let me just note that in this discussion about the operations of the Congress and bipartisanship, that this entire effort has been bipartisan from the beginning. And this hearing is further evidence of it because the chairman has, in a very tight window, you know, allowed us to go forward from where we were last year where we had our first ever hearing in the appropriations process on neuroscience.

We are to continue that this year, and I want to thank you, but it is not surprising because the chairman and I worked together on another subcommittee where we did some very, very important work on brain health in terms of veterans. When he previously chaired the Veterans and Military Construction Subcommittee, you know, we worked together and made major investments through the VA and Epilepsy Centers for Excellence and post-traumatic stress and suicide prevention, and on and on and on. And the VA, obviously, was one of the entities that—the departments that worked with the Interagency Working Group.

So I want to welcome our witnesses. We have done a lot in this committee since 2011 when we created the Interagency Working Group, and we are now working aggressively. We have doubled the amount of dollars through the National Science Foundation focused on this after the creation of what is called a budget theme, and the understanding of the brain, we are going to hear more about that day.

And last year's appropriations bill moved to include an important element of the Nation's scientific enterprise, our National Labs, working with the National Science Foundation on the development of a national brain observatory. So I am excited. We are going to hear about where we are with the BRAIN Initiative in terms of mapping of the brain. We are going to hear a lot from your testimony today.

And, again, I thank the chairman because he has through—I mean he has got a lot of interests in terms of space exploration, but it has no way had him step back from a commitment to make sure that we keep our eyes focused on the greatest scientific mystery that we know of, which is how our brains, which controls everything else, actually functions, and so I thank the chairman and look forward to your testimony.

Mr. CULBERSON. Thank you, Mr. Fattah.

This is an extraordinary and exciting subject. We are honored and privileged to have each one of you with us here today to help keep us apprised of the cutting-edge work that is being done in the United States and elsewhere in the world.

And we will of course enter your written statement into the record without objection, and would welcome you to summarize your statement as best you can.

Thank you, and we will start with you, Dr. Handelsman. Thank you.

Dr. HANDELSMAN. Thank you. Chairman Culberson, Ranking Member Fattah, and members of the committee, I thank you for the opportunity to speak today on the Federal investments in neuroscience and neurotechnology. The White House and OSTP support several neuroscience and mental health activities, including the Interagency Working Group in Neuroscience, the BRAIN Initiative, the National Alzheimer's Project, the initiatives to tackle mental health issues affecting veterans, service members, and military families.

Diverse sectors of the American population face risks related to brain health—from concussions in athletes to Alzheimer's in the elderly. Recent studies estimate that as many as 5.1 million Americans age 65 and older have Alzheimer's; 18 percent of service mem-

bers returning from Iraq and Afghanistan have PTSD or depression; and each year approximately 2.5 million civilians in the U.S. sustain a traumatic brain injury.

Scientists have been exploring the underlying nature of these brain disorders with the hope of developing preventive strategies, treatments, and perhaps cures.

One obstacle has been the absence of sufficiently sensitive neurotechnologies to see with precision what is happening inside the active brain. The Obama Administration's BRAIN Initiative intends to help overcome this particular obstacle. Since its launch in 2013, the BRAIN Initiative has grown to include investments from five Federal agencies—NSF, DARPA, IARPA, NIH, and FDA. These agencies have refined the goals of the BRAIN Initiative, developed funding opportunities, and awarded initial grants.

Dr. Olds will share with you some of the exciting work at NSF.

Work funded by other agencies is focusing on recording activity in the human nervous system, enhancing and developing new neuroimaging technologies, fostering developments in data handling and advanced analytics, and understanding capturing the brain's computational abilities.

Federal investments of the foundation of the BRAIN Initiative but completion of the broad goals of this initiative will require complementary efforts by a variety of organizations outside the Federal government.

To date, private sector partners have made commitments totaling over \$500 million in just the first 2 years of the initiative.

The Federal engagement in neuroscience is much broader than just the BRAIN Initiative. With the encouragement of Congress, including members of this committee, an Interagency Working Group on Neuroscience was established in 2012 to coordinate neuroscience research across the Federal government and identify opportunities for international collaboration and communication. The Neuroscience Working Group includes representatives from more than 20 Federal agencies and departments that have interests in neuroscience research.

I describe some of the working group's interagency coordination activities in my written testimony.

With regard to international collaboration, for example, last month the National Institute on Aging and its HHS sister agencies convened a followup to the 2013 G8 dementia summit, at which international partnerships for interdisciplinary research on the causes, prevention, and treatment of Alzheimer's were discussed.

Also, NSF and NIH, in collaboration with German, French, and Israeli science organizations, have jointly funded collaborative research in computational neuroscience to facilitate international sharing of brain experimental data as well as analysis tools.

On the domestic front, great strides have been made over the past year in mental health care for our service members, veterans, and their families, including improvements in continuity of mental health care and mobilization of community clinicians and peer counselors to increase access to services and to assist in suicide prevention.

Thanks again for the opportunity to be here today. While there is still certainly much to be done to meet the needs of Americans

facing neurological disorders and diseases, Federal investments are already making progress toward improving our understanding of the underlying neuroscience that will lead to preventive strategies and treatments. I thank the committee for its continued leadership and vigorous support for these issues. And, of course, I will be pleased to answer questions of the members.

Mr. CULBERSON. Thank you very much, Dr. Handelsman.

Dr. Olds, we look forward to hearing from you, and, you know, not only is your work so important on helping veterans and traumatic brain injury, it is also, I think, relevant and it will be interesting to know what—if at some point during the questioning you might be able to offer us any insight about how would you potentially spot someone like this pilot of the German aircraft that might be on the brink of doing something terrible that it looks like his act was a deliberate act. And it may indeed be work that is done by—by scientists like yourselves that might be able to help airlines spot something like that about to happen.

So we look forward to your testimony, Dr. Olds. Thank you.

Dr. OLDS. Chairman Culberson, Ranking Member Fattah, and committee members, thank you for the opportunity to testify before you today on this important topic.

My name is Jim Olds, and I am the Assistant Director for Biological Sciences at the National Science Foundation. I am on leave from George Mason University where I am a professor of neuroscience.

Today I will outline the NSF's focus on understanding the brain. I hope to make three overarching points. First, the brain may be the most complicated system that we know of in the universe. It is a big data problem. Second, neurotechnology has advanced neurobiology to the point where we can explore new questions that were previously unapproachable. And, third, understanding the brain is an international effort that is bigger than one country and requires coordinated resources.

Mr. Chairman, historically significant advances in brain research have resulted from broad areas of research in neuroscience and related fields. However, there remains much to be discovered if we are to achieve a comprehensive understanding of how the healthy brain's structural organization and dynamic activities produce cognition and behavior and how the brain can recover functions lost to disease or injury.

Allow me to share one example. The current state-of-the-art, noninvasive functional brain-scanning technology is off by a factor of 1,000 when it comes to resolving the actual neural code of human brains, both in time and space. If we are going to truly understand the brain, we are going to need a next generation of tools that will allow us to resolve brain function at the speed of thought.

In its fiscal year 2016 budget request, NSF initiated "Understanding the Brain," a multiyear effort that combines cognitive science and neuroscience activities with NSF's participation in the BRAIN Initiative.

NSF's overall goal with this activity is to enable the scientific understanding of the full complexity of the brain in action and in context.

Understanding the Brain will draw on existing research investments to foster greater collaboration and to accelerate fundamental research. We will invest in neuroscience, cognitive science, neuroengineering, and the neural bases of learning, and how the brain adapts to changing environments. NSF is requesting \$144 million in fiscal year 2016 for investments in Understanding the Brain. This almost doubles NSF's historical investment and builds on \$92 million awarded in fiscal year 2014.

In April of 2013, President Obama announced the multi-agency BRAIN Initiative. I know that Congress was very much involved in its creation, and I want to specifically acknowledge and thank this Committee's foresight in this matter.

Since its creation, NSF has targeted significant funding for the BRAIN Initiative. This is an exciting time because neurotechnology advances are allowing us to pursue an understanding of the brain that was opaque to us in the past. NSF is uniquely positioned to advance research on understanding the brain by bringing together a wide range of scientific and engineering disciplines, each of which brings its own unique perspective to the brain challenge.

NSF has consistently been a catalyst for transformative breakthroughs. For instance, I mentioned earlier the limit on functional imaging technology in representing brain activity. Just this past year, NSF funded a novel project to develop a new generation of brain measurement technologies, and if successful, this will transform our ability to observe the dynamic activity in living brains. This is a great example of how rapidly NSF works to accelerate discovery.

In fiscal year 2014, five NSF directorates invested \$11 million in 36 highly interdisciplinary proof-of-concept awards called EAGERS that focused on neural circuit function. These strategic investments in fundamental research and infrastructure will transform our understanding of the brain, reveal the neural basis of thought and behavior, and show how to maintain a healthy brain throughout our lives.

To close, I want to note that understanding the brain is an international challenge that is bigger than one country. Just as modern physics needs CERN—the largest particle physics laboratory in the world—neuroscience needs internationally coordinated resources. This includes creating the ability to share the vast amounts of data that will be generated by the challenge.

I thank this committee for recognizing the size of the brain challenge and encouraging NSF to work not only with other agencies, but other nations. NSF will continue to work with multiple partners and stakeholders to address important gaps in our knowledge and to enable scientists working across disciplines, institutions, and nations to collect, share, and analyze the new data that will reveal the biological principles that produce the functioning human brain.

Our goal, as always, is to provide the best possible science for the country. Thank you, again, for the opportunity to testify and for your attention.

Mr. CULBERSON. Dr. Olds, thank you very much.

As we go through the—in your opening statements, I would particularly be grateful and we may do—we will certainly do some of

this in the questioning as well, talk to us about some of the successes. We are very supportive of the investment. That is why we are here today. Very supportive of the collaboration. That is why we are here today. Really appreciate the work that you are doing. Delighted to hear about the collaboration and the money that has been invested in the past and that needs to be invested in the future. We are supportive of that. That is why we are here today. Tell us about some of the exciting new discoveries. I mean, that is where we really—that is what we want to hear about today, and what—what is working and what is not, and where, then, do we need to focus our attention, as you could, if you don't mind, in your opening statement? We will get into that in some of the questionings too, but I would love to hear it in the opening. Thank you.

Mr. Lynch.

Mr. LYNCH. Mr. Chairman, Ranking Member Fattah, members of the subcommittee, I am Zack Lynch. I am the founder and executive director of the Neurotechnology Industry Organization, and I thank you for the opportunity to provide testimony today on behalf of NIO on how to maximize the societal return on Federal investments in neuroscience research.

NIO is a nonprofit trade association that works to accelerate the development of treatments and cures for brain-related illnesses. With over 100 members, NIO represents emerging neuroscience companies, academic brain research institutes, and patient advocacy groups across the United States and the world.

Today more than 100 million Americans suffer from a brain-related illness. That is one in three. These include Alzheimer's, autism, addiction, depression, epilepsy, multiple sclerosis, Parkinson's, schizophrenia, stroke, and many more. They also include post-traumatic stress and traumatic brain injury, which disproportionately affects members of our armed services.

The combined economic burden of all these diseases has reached over \$1 trillion a year in the United States alone. And this economic burden is accelerating as the population ages and expands, creating unprecedented demand for new treatments to cure neurological diseases and psychiatric illnesses.

Now, in neuroscience, Federally funded research has always provided the scientific foundation upon which the private sector builds the next generation of therapeutic products. The National Institutes of Health continues to be the largest and most innovative funder of basic neuroscience worldwide. This investment in brain science and the SBIR program is critical for ensuring that the pipeline of neuroscience innovation remains robust.

Accordingly, NIO requests that Congress appropriate at least \$30.7 dollars for the NIH in fiscal year 2016. This 2.2 percent increase keeps real purchasing power flat, adjusting only for an increase in the biomedical research and development price index.

When it comes to the brain, however, we must do more than simply fund basic neuroscience research. We must improve public health. We must stimulate broad economic growth. And we must create new jobs.

Two years ago, recognizing both the unique challenge and opportunity in neuroscience, President Obama launched the BRAIN Ini-

tiative. This ambitious effort aims to invigorate investment in neuroscience in much the same way that the human genome project and the national nanotechnology have done previously.

Our industry is tremendously excited and optimistic about this program and its prospect to spur innovation, and we thank Congressman Fattah for his continued efforts in this initiative.

I think it is most important to note that unlike any other area of life science research, neuro—investing in neuroscience will create direct economic benefits far beyond just reducing healthcare costs and alleviating human suffering.

Let me give you two brief examples: Information technology, a multitrillion-dollar-a-year industry that sits on the cusp of being transformed by brain-inspired computing. Neuroscientists are researching the human brain for clues on how to design computers that can modify their hardware and software in realtime and modify themselves based on experience, just like the human brain does. As well as create radically efficient computers, the human brain runs on less electricity than a single light bulb. This area of cognitive computing represents a competitive advantage for American companies and will significantly impact economic growth and job creation and national security if we choose to invest wisely today.

Education. Total expenditures in education have reached over \$1 trillion a year, and yet the results are not helping our citizens remain globally competitive. Neuroscience can help us leapfrog this education performance gap. By developing fully personalized learning systems that tap into our natural neuroplasticity, we can safely accelerate learning, knowledge creation, and innovation.

Now, looking forward, the convergence of neurogaming and neuromodulation with advances in self-learning computing will open up an entirely new realm of value creation of purely digital experiences that can be created and consumed with virtually no impact on global physical resources.

For example, one could sell virtual experiences complete with emotional stimulation with unique landscapes or immersive health environments that enhance mental well-being.

NIO believes that the BRAIN Initiative can and should play an essential role in accelerating the translation and commercialization of breakthrough neurotechnology. Accordingly, we ask that Congress allocate \$300 million to the BRAIN Initiative in fiscal year 2016.

Additionally, we recommend the consideration of a budget-neutral program modeled on the Orphan Drug Act that will increase private investment into much needed treatments for neurological and neurodegenerative diseases.

Investing in neuroscience offers both treatments to terrible diseases but also a grand opportunity for economic revitalization and dramatic improvements in individual resiliency.

Today's neuroscience funding is inadequate if we want to lead the 21st century and beyond. I call on your subcommittee to strengthen our commitment to neuroscience funding to take advantage of the opportunities associated with the brain. I am confident that this approach will provide new treatments to terrible brain-related illnesses, transform industries, and create entirely new economic drivers for growth and jobs if we invest properly.

Thank you for your attention, and I would be happy to take questions when you open it up to the panel.

Mr. CULBERSON. Thank you, Mr. Lynch.

Fascinating. Cognitive computing is exciting, but I share some of the fear of others in the idea of artificial intelligence. We want to avoid a Skynet situation. Dr. Hyman. Thank you. Look forward to hearing from you.

Dr. HYMAN. Chairman Culberson, Ranking Member Fattah, members of the subcommittee, my name is Steven Hyman, and I am offering this testimony both in my capacity as president of the Society for Neuroscience, and as a fellow of the American Association for the Advancement of Science. I am also director of the Stanley Center for Psychiatric Research at the Broad Institute of MIT and Harvard, and serve as Harvard University Distinguished Service Professor of stem cell and regenerative biology.

The mission of the Society for Neuroscience is to advance understanding of the brain and the nervous system. AAAS, of course, has a broader mandate led now by newly installed CEO Rush Holt, which is to advance science and engineering and innovation throughout the world for the benefit of people.

On behalf of both organizations, I deeply thank you for your support for neuroscience research and for the opportunity to testify here.

In order to be responsive to the chairman, I will—instead of summarizing my remarks—I will try to put in context some of the advances that have come from the kind of funding we have had if you will also forgive me for the errors which will undoubtedly crop up from spontaneity.

I think something to put these needed successes in context is probably well known to all of you, but that is not just the economic cost or the numbers created by brain disorders—one in three Americans is a very good number—but the impact. So while brain disorders can kill, stroke kills, and, tragically, suicide, suicide remains among the three leading causes of death for young people in this country, most of the damage done by brain disorders is through disability, whether it is a child with autism who, if they are at the more challenging end of the spectrum, may never succeed in education and won't be able to work in ordinary circumstances; schizophrenia, which is perhaps relevant to the incident with the aircraft that you reference. We don't know yet what was going on. But particularly cruel because onset is in late teens or early 20s just when families and society have made a maximum investment in a young person, getting them through college or technical school, and then they become essentially disabled for the rest of their lives. And our treatments are better than nothing, to be sure, but much remains desired. And, of course, Alzheimer's disease has been referenced already. But, again, we are facing a catastrophe here not only in terms of the individuals but also caregivers and families who get removed from the workforce.

Now, the problem—and I think Dr. Olds said this very well—has been that the brain is not only complex, but I would add one other factor which is a required technological advance, which is it is inaccessible in life. Cancer is a very hard problem, but we neuroscientists would say, perhaps unfairly, that it is an easier

hard problem because a surgeon does an excisional biopsy and hands the scientist the disease, whereas for the human brain, which is poorly modeled in animals in many cases—not all cases, especially the thinking parts of the brain—you know, we can't reach in and take tissue. And so we have to examine the brain indirectly, which is why some of these imaging initiatives are so important.

That said, based on basic science and tools and technologies that have emerged in the last few years, there has been to my mind really breathtaking progress, and it hasn't yet led to treatments that generalize, but I think we finally are beginning to see a path.

Let me give you just a few examples of these successes.

So, for autism and schizophrenia, these were very mysterious illnesses. We could do brain imaging, but, again, the—exactly as Dr. Olds said, we are really looking only at ensembles of millions of neurons firing. We are not seeing what is actually going wrong. We had always known these disorders run in families. I mean, they don't—it is—they were not like Mendel's peas. It is not like, you know, in any family if one sibling has it, the other will have it. It skips generations and so forth, but we have known that these are highly genetically influenced illnesses.

The problem for common illnesses is that they are not caused by a single gene creating a problematic mutation, as in the case of Huntington's disease, but many hundreds of genes contributing small effects. We had no possibility of detecting these.

What has happened because of the—really the Federal investment in research across NSF, NIH, Department of Energy, is that the cost of sequencing DNA has come down about a millionfold in the last decade. It is really quite remarkable. Everyone has heard of Moore's Law about transistors on a chip. The cost of sequencing DNA makes that look rather torpid. Where I work now, the cost of a whole human genome is between \$1,000 and \$2,000. And I would add the bill we pay to Amazon for putting the data in the cloud is \$500. So these costs are converging, and we need our colleagues to improve some of the computing.

But the point is, based on this technology, we can now afford to and accurately study many tens of thousands of patients. And as a result, the community has created durable global collaborations, and as a result, we now have the first literally 110 genes that are involved in causing schizophrenia. Now, these are—these are early clues, and there will be many more, and it is very hard to put them to work, but all of a sudden we have gone from a complete black box to light at the end of the tunnel, and pharmaceutical industry, which has fled this area as too difficult is now starting to dip their toes back in the water.

One other really interesting example is something called optogenetics. Optogenetics is a tool in which one can, using, say, an injected viral vector in the brain of an animal or even making a transgenic animal, another fantastic technology, introduce an ion channel that comes from microorganisms in invertebrates, so something discovered in basic science, and then these channels get activated by light—I mean, all of us know our house plants, you know, move toward the light. What is the mechanism? There are all of these kinds of light sensitive channels in nature, but we can exploit

this with fiberoptics to control—to turn on and turn off the cells in the brains of animals and begin to really understand how circuits are working. And this has absolutely in the last 3 or 4 years revolutionized our understanding in animal models of behavior. And while we are not going to put fiber optic devices in human brains, it has also inspired a number of investigators, undoubtedly funded by both NSF and NIH but also involved with the DARPA aspects of the brain project, to think about how these principles might apply to human diseases, Parkinson's disease and other diseases before we have begun to know the circuitry.

It is a really exciting time, and I would just end by saying that one of the things that the Brain Project does, which I think I am really very—I have been in the government, but I am really pleased with how the government has worked on this—has created a bottom-up endeavor that is going to build new tools—because we need these tools and technologies to get inside our skulls, literally—and engage these broadly for science but also ultimately in the service of human health and also will bring new kinds of thinkers into all of our portfolios. People who have been funded perhaps by the Department of Energy who have never thought about biology or the brain before, and so I absolutely, on behalf of the organizations I represent and also personally, thank you for your support of these endeavors, and I would be delighted to take any questions.

Mr. CULBERSON. Thank you very much, Dr. Hyman.

It is an extraordinarily exciting field of research, and you think about the size of the human genome and how little we know about what those genes do. We don't know, what, over 90—what is the percent—what percentage of the genes in the genome do we know what they—

Dr. HYMAN. Well, you know, that is even a tricky question because often, you know, nature reuses the same gene in different cell types for different purposes. And so even where we know one or two purposes, we often don't know what they are doing in the brain. We understand best the 1 to 2 percent of the genome that codes for the protein building blocks of cells. The rest, which when I was in college we were told was junk, is actually quite, quite busy, and we are just at the earliest stages of understanding what the other 98 percent of the genome is doing.

Mr. CULBERSON. I suspect God doesn't do anything that doesn't have a purpose.

Dr. HYMAN. That is a very good maxim to live by. Yeah.

Mr. CULBERSON. Absolutely.

Absolutely fascinating, but I noted also, and you didn't mention this in your summary, Mr. Lynch, about the importance of us making sure that we have got legislation encouraging companies to invest in orphan drugs, which is something you mentioned obliquely, but—

Mr. LYNCH. Yes sir.

Mr. CULBERSON [continuing]. Really, really important because a lot of these medications and these problems are—involve populations that may be too small for the companies to be able to see that there is an economic benefit, and that is just vitally important.

Some studies have mentioned that many neurological disorders stem from a misfolding of a protein in the brain which can lead to

a cascade of effects that result in ALS or Alzheimer's, Parkinson's and other neurological diseases. And traumatic brain injuries apparently also cause a similar misfolding of proteins with a cascading effect in the brain.

Has it been solidly established that this protein malfunction is a potential root cause of these neurological diseases. And if we have indeed identified the root cause of these issues, could you tell us where we are in finding a cure and being able to either stop or reverse the cascade effect in the brain when these proteins—

Dr. HYMAN. Yeah, it is really quite clear. I mean, proteins, first of all, you know, come out—they are read out as a linear structure. And then there are all of these mechanisms inside the cell to make sure they have exactly the right confirmation to do their job—

Mr. CULBERSON. And then some of the folding, I understand, is just a result of random chance about where they are positioned in the cell. They don't have enough elbow room to fold correctly.

Dr. HYMAN. You should teach biology. That is exactly—and then but they get stabilized, depending on negative and positive charges, or, you know, they will bounce around stochastically. And then they will come to the right confirmation. And then there are other proteins called chaperones which help them, you know, stay in the right confirmation. This is complex process that often fails, and normal cells must have a mechanism to degrade and remove these misfolded proteins.

Mr. CULBERSON. So complex, in fact, you have had to crowdsource it. I have signed up for that project to do the protein folding, and I let the computer run it in the background, and you have really got—I also signed up for the one classifying galaxies, which is—that is what I do for fun.

Dr. HYMAN. But, well, the force is—

Mr. CULBERSON. But it is so vast a problem you literally—I am sorry.

Dr. HYMAN. No, no. No, I am sorry. No, no. I was going to say gravity works—for galaxies—doesn't work at that scale—

Mr. CULBERSON. I mean, the scale of the problem is so huge; crowdsourcing is one of the best ways and the size of the—

Dr. HYMAN. Yeah. There are a lot of quantitatively talented people who might be spending their lives in finance who, you know, make—could really, you know, in their extra time do some really good things here thinking about protein folding and other problems.

But at any rate, you are absolutely right. It has been extremely frustrating, to take one example, that the gene that causes Huntington's disease, which is rare but not, you know, terribly, terribly rare, invariably lethal, with a terrible end course or some forms of—some of the familial forms of amyotrophic lateral sclerosis.

Mr. CULBERSON. My sister-in-law's family has it.

Dr. HYMAN. Well, right. So you—I don't have to tell you how awful these conditions are.

Mr. CULBERSON. She is clear, but her sister is not.

Dr. HYMAN. Yeah. So, again, technological innovation has given us—I don't want to over promise, but I think it has given us some really promising clues. So you can think of these mutations that cause protein misfolding or other mischief—

Mr. CULBERSON. Or injury.

Dr. HYMAN. Or injury—as poisons in every cell, and the idea that a drug will work in all of the—now, in ALS, of course, it is really motor neurons, but they are affecting other cells. The fact that—the idea that you could sort of somehow neutralize this poison with a drug is very challenging. A new idea, based on the ability to deliver RNA molecules, which would interfere with translating from the DNA message these aberrant proteins that—the mutant form of Huntington or some of these familial forms of genes that cause ALS—and literally try to shut that gene off in the brain or in motor neurons is an entirely new, you know, last year or two this idea of gene silencing, which I think is an, you know, unproven but a really interesting idea, but we couldn't think about it without the technological advance of how would we get these neutralizing molecules into the right cells. Still an unsolved problem, but something probably some of your members might even be thinking about.

Mr. CULBERSON. The poison you were referring to could also be thought of, I guess, in terms, perhaps, of like inflammation. I have been a subscriber to the Journals Nature and Science for over 20 years and don't pretend to understand all of it, but I read them cover to cover and—

Mr. HYMAN. I don't understand them.

Mr. CULBERSON. Yeah. I know, but it is fascinating and noted that there was an article I know a year or two ago about the effects of chronic inflammation as a root cause of cancer, for example, as just a constant source of irritation or causing damage that then triggers an uncontrollable cascading mutation of cells. Is that similar to what you are talking about here?

Dr. HYMAN. Well, it is—

Mr. CULBERSON. Conceptually.

Dr. HYMAN. It is conceptually similar. I think, in familial ALS and Huntington's, there is actually a very precise target, which is this mutated gene, that is leading to these terrible symptoms and death. And we can at least know exactly what we need to shut off, whereas in inflammatory disorders, there are many, many molecules involved and—

Mr. CULBERSON. But to prevent the inflammation is to prevent the underlying—

Dr. HYMAN. That is correct. Absolutely. Absolutely.

Mr. CULBERSON [continuing]. And the subsequent problem.

One of my other passions—I am going to turn it over to Mr. Fattah—a long-term passion of mine that I hope in the time I am privileged to chair this subcommittee and work with you and all our other members is to identify—be able to identify in the future a genetic problem like that in an unborn child through the amniotic fluid and whip up a protein fix that you could then inject back into the amniotic fluid which the child would then breathe and repair and cure the child's disease before she is born. So that is absolutely possible. Isn't it?

Dr. HYMAN. Yes. Mr. Chairman, if my colleagues—maybe they want me to quiet down, but there is yet another exiting technology called CRISPR/Cas-9—well, I will explain what this is. So—

Mr. CULBERSON. CRISPR—

Dr. HYMAN. CRISPR, C-R-I-S-P-R, hyphen, C-a-s 9, and it is in the news because leading scientists have said, We better call a halt on any human experimentation right now, see where we are ethically and in terms of safety, which is not to end the research. But let me describe was this is.

Bacteria get infections too. Viruses invade them and kill them, and so bacteria need to have an immune system. And what they do is they, in some cases, is they—they form a memory of—they don't want to cut up their own DNA, so they form a memory of what the DNA of the viruses that afflict them. And they have invented basically molecular scissors to cut the DNA that gets recognized. We as a community—

Mr. CULBERSON. When that DNA shows up, the molecular scissors go into action and chop it up.

Dr. HYMAN. Right. Something binds to it—

Mr. FATTAH. Zombie immune system.

Mr. CULBERSON. Zombie immune system. That is nice. Got to use that.

Dr. HYMAN. Yeah, exactly.

Mr. CULBERSON. Can you plagiarize that?

Dr. HYMAN. Mr. Fattah, if that is not copyrighted, you know—

Mr. FATTAH. I am a public figure. You can use it.

Mr. CULBERSON. Zombie immune system.

Dr. HYMAN. But basically we can now use the same system, and this is now widely used in both microorganisms and animal models to cut DNA where we want because we can engineer the recognition strips, these so-called guide RNAs, and cut DNA. And then there are other well-known mechanisms to insert new pieces of DNA.

So this is now an experimental tool that we are using to put the genes we discover about schizophrenia into cell lines. But the idea is that in a human potentially—and, again, this is really fraught and it is really early—you could do pregestational diagnosis. You could find the mutant gene for a single—for monogenic disorders like—

Mr. CULBERSON. Huntington's or—

Dr. HYMAN. Huntington's, that are caused by a single gene.

Mr. CULBERSON. Right.

Dr. HYMAN. You could design guide RNAs. You could cut out that version and then replace it with a healthy version.

Now, there are all kinds of safety risks. There are all kinds of ethical risks because people might want to use this technology to make people taller or whatever.

And we really have to think deeply about this, but I think we are entering an era where exactly what you have imagined may become possible.

Mr. CULBERSON. Texas Medical Center, which I am proud to represent, I have been pushing them for years on this. And they tell me it is possible.

Dr. HYMAN. Absolutely. And that is a great institution.

Mr. CULBERSON. Thank you. Thank you for letting me take so much time, Mr. Fattah.

Mr. FATTAH. Mr. Chairman, no. Thank you for your interest in these and all matters of science. So you can see my chairman is engaged. So it is very important.

I want to make sure we go back because, in order to respond to the chairman, you kind of ad-libbed your remarks, and I want to make sure that we put on the record—this is a very important part of our process, hearings and public record—the scientific challenge in front of us.

So the human brain, as best as we understand, about 100 billion neurons, 100 trillion connections. It runs on low electricity and it does a lot, and we don't understand much of it. Is that right, Dr. Olds?

Dr. OLDS. I would say that we are very good stamp collectors right now and we are working diligently on coming up with a theoretical framing for a rule set for how those 100 billion neurons work with each other.

Mr. FATTAH. I went out to Stanford and met with one of your colleagues, Dr. Newsome. He says, you know, if we are talking about looking at a map, we don't see the highways, the roads. We don't really have a good understanding and, even if we did, we don't understand the traffic that is on there. Right?

So Paul Allen came into Philly. He announced a major investment into a cell institute. Now, he has already put a half a billion dollars into a brain institute. The cell institute is to look at the 50-plus trillion cells in the human body.

But one of the things—the reason I was there—it was in Philly, but the reason I was there was that, in the cells in the brain, we don't yet know all of the cells in the brain and the cell types. Is that accurate?

Dr. OLDS. That is accurate. So a simplifying approach to understanding the brain is to take the 100 billion cells and classify them into their different types.

Mr. FATTAH. Right.

Dr. OLDS. And we are in the process of doing that, but—

Mr. FATTAH. But we are not there yet.

Dr. OLDS [continuing]. We are not there yet.

Mr. FATTAH. Right. Because I want the chairman just to work with me here so we have got a system in which there is a lot of interactions with the neural network that we don't understand, and we don't understand even the basics, the, you know, kind of identification of all the cells.

So, the effort here is one of, you know, from just a task, it is a gigantic task. Right? So one of the things that the committee did in last year's bill was we did move to internationalize and to create collaborations and we have tasked the National Science Foundation with having—with developing an international conference because there is these efforts.

And the committee has supported my work, whether it is Israel or the EU and others, to try to kind of cobble together. The EU has now put a billion and a half euros on the table for the Human Brain Project, Henry Markram. There are a lot of interests in trying to work together because there are, based on the World Health Organization's number, over a billion human beings with a neurological disease or disorder. Right?

And the contention is that, at least as I approach this, is that we need a basic understanding of how a healthy brain would function as at least part and parcel to trying to figure out what to do about some of the challenges.

So as the National Science Foundation is understanding the brain, we saw the EAGER grants, which were great, and we see your request this year.

The basic next steps, as you see it, where we need to go, if you could talk to the chairman and I about that in terms of the cost side. Right?

So, you know, we know on the health side we spent a lot of money. We spent \$210 billion last year on care for Alzheimer's. Right? So I know we spent a lot of money.

We spent \$500 billion on mobility challenged Americans. So these are people who have suffered from stroke or some traumatic brain injury. And so we are spending a lot on the care side. We are spending a paltry amount of money in trying to figure out any of this.

And the way I would phrase it, Mr. Chairman, is the Allen Institute, which just spent a half a billion dollars, they have now completed an essential framework for how the mouse's brain works. Right? And it is about a million neurons?

Dr. OLDS. No. Ten.

Mr. FATTAH. Ten million. Right.

So they got this thing, so that is about where we are. Ten million versus this 100 billion. And that is a mouse. And the translation from animal to human is about 1 percent in neuroscience, different from, in all other areas it is about 50 percent. So if you can find a cure in an animal, 50 percent of the time it will work in a human being.

When you talk about the brain, it is 1 percent translation. So even when you find something that makes a mouse, you know, operate a little bit better, restore memory, whatever, you can't bet the ranch that you are going to be able to translate it to a human being. Is that correct?

Dr. OLDS. Correct.

Mr. FATTAH. All right. So talk to the chairman about where we need to be going over the next, me and him are going to be here for the next 10 years doing this, and we want to see at the end of this or sooner major relief for these families who have these challenges. Right?

We also are interested in the science and the sexiness of this, but at the heart of this is human beings, a billion of them worldwide, 100 million in our own country. And so talk to us about how you see us not just this year, but over the next period of time here what we need to try to get done.

Mr. CULBERSON. Yeah. Where we need to focus our efforts. That is a great question, probably the best question—

Mr. FATTAH. To make disruptive progress.

Mr. CULBERSON. Yes.

Dr. OLDS. So in June we are going to be engaging in something called an "Ideas Lab" in collaboration with the Howard Hughes Medical Institute intramural campus at Janelia Farms, just across the river.

Mr. CULBERSON. Where?

Dr. OLDS. Janelia Farm of Howard Hughes Medical Institute. It is just north of the Dulles runway.

And the goal of that meeting is to pull together scientists from disparate fields to crack a very simple circuit in the brain, the olfactory circuit. It is one of the most ancient circuits in the brain. It is conserved across evolution.

It is tractable from an engineering standpoint because the sense of smell doesn't go through a relay nucleus like the rest of our sensations do. And the goal is to take a very simple circuit, bring together scientists from a wide variety of disciplines, and crack that simple mechanism.

Mr. FATTAH. Can you yield for a second?

Dr. OLDS. Sure.

Mr. FATTAH. Mr. Chairman?

Mr. CULBERSON. Oh, please.

Mr. FATTAH. I was just at the Weizmann Institute in Tel Aviv, well, in Israel, right outside of Tel Aviv, and they just created this, they have been working on this bionic nose with some funding from the National Science Foundation.

These 6 million neurons that are right up here, they are below the blood-brain barrier. So they are very interested, neuroscientists are very interested in them because they can reach them.

But this nose is at University of Penn, they developed some ability of getting dogs to sniff out cancer. So they have been able to get this bionic nose to sniff cancer and, also, explosives and illegal narcotics. And it is fascinating.

But go right ahead.

Dr. OLDS. So the next steps would be to actually understand how more complicated circuits work. This olfactory circuit is a relatively simple one. There are more complicated circuits, such as the mammalian hippocampus, that play a critical role, for example, in Alzheimer's disease.

When we catch Alzheimer's disease, the cells of the hippocampus die, and that is the same circuit that allows us to remember episodic memories, the movie of your life, if you will. That is a devastating symptom.

It is a circuit that we known an awful lot about. The input and outputs are not as well known as with the olfactory circuit, but it is a circuit that is tractable. And it would be a logical next step.

So the goal is to actually develop an understanding of how relatively simple important circuits work in the brain and then bring together that understanding of circuits to actually see how circuits communicate with one another in the brain.

So that yields a road forward where we can actually understand how circuits that actually may be involved in diseases like Alzheimer's or Parkinson's or autism actually, in their communication, go awry and what potential therapeutic strategies might be. But that all starts with an understanding of the healthy brain.

Mr. FATTAH. Well, Mr. President, it is good to see you again.

As President of the Society for Neuroscience, you have, the chairman mentioned earlier about this misfolding protein issue. And there is a member of your group, Dr. Soto, who is at the University of Texas at Houston, who has spent some considerable amount of

time looking and he has really been working, he thinks that this, that the idea of this misfolding protein is, you know, the key to a number of these different disorders.

I am trying to get, and I didn't get it directly from what Dr. Olds said. We are going to try to start with one place and move to the next place. I am trying to get a sense of where, if we were going to make a major leap forward, you sense that we need to be investing resources and efforts.

Dr. HYMAN. Yeah. I think there are—one way of thinking about it is there is a shared mechanism. Right? A protein has misfolded and the cell chokes on it, doesn't—is unable to get rid of it.

And that might be something across many different diseases. But for each particular disease it is one or another protein that is genetically producing a protein given to misfolding or sometimes a disposal mechanism that isn't working.

So I think there are two major useful areas of focus. And, again, I think there is some—there have been some very important investigators in Texas, Huda Zoghbi's lab at Baylor, for example, that has found a lot of these mutations that are devastating in children.

So I think one important focus is to identify these genes and figure out ways in which we can potentially silence them or, if the CRISPR/Cas-9 scenario works out over time, even replace them in an embryonic stage, again, with all of the ethical concerns that need to be addressed first.

But the alternative, which is more general, not disease by disease, is actually to better understand the mechanisms by which cells clear misfolded proteins and to see whether there are ways in which we can improve that set of processes in a way that might work across many different diseases. I won't go into the technical, you know—

Mr. CULBERSON. You see that as one of the root causes of a lot of things—

Dr. HYMAN. It is a very—there are a lot of—yes. Yeah. Yeah.

And then, again, you mentioned something that is new, but interesting, is that, in traumatic brain injury, this protein Tau, which has also been implicated in Alzheimer's disease, may not only create inappropriate tangles inside of neurons, but when they die, it may be released and almost infect neighboring neurons and spread some of the damage. Again, early, but really, really interesting and important work.

Mr. FATTAH. Last question for, okay.

Mr. Lynch, the Potomac Institute released a study on neurotechnology 3 years ago, and they said that, from an economic standpoint, the economics of this in terms of GDP would be more impactful than any of the other economic revolutions in our country if we were able to figure out some of these problems, solve them, and build the industries that would benefit from them.

So you are involved on the industry development side of this. In terms of venture capital, in terms of the work, one of the things that I have seen internationally is there is a lot of action in this space—right?—people trying to figure out diagnostic tools, people trying to figure out, you know, treatments.

And where do you see America relative to the development of the neurotechnology industry?

Mr. LYNCH. Well, thank you for that question.

I would like to return, in answering you, to the point you were trying to make earlier, which is these are exceedingly complex problems we are trying to solve.

And to Dr. Hyman's points earlier, much of the breakthroughs that we are talking about that he articulated, whether it was neurogenomics, CRISPR/Cas-9, optogenetics, those were all borne out of the Federal investment in the human genome project. Right?

And so what we are talking about here is: How are we actually going to solve these problems with the brain and develop treatments and cures for individuals who are suffering and alleviate these problems that are occurring with these families and the drag on the economy as a whole? We need to invest in fundamental brain research, in the BRAIN Initiative. We need to step it up and push forward.

So what I represent is the neurotechnology industry. There are currently 800 companies worldwide right now that are developing treatments for neurological diseases and psychiatric illnesses. About 450 of those reside in the United States itself.

Last year this industry generated about \$150 billion in revenue in and of itself. That includes selling pharmaceuticals for anxiety, depression, epilepsy, multiple sclerosis. So there is a big pharma element to this industry.

But the breakthroughs—they have basically left the “R” in neuroscience aside because of the hyper-complexity associated with developing these new treatments and are looking to these gentlemen to actually find some new technology so that we can get some insight into how we are going to develop these next-generation treatments.

So from the venture capital side, we have been hosting a neurotech investing and partnering conference for 10 years now, and each year it brings together, you know, a modest number of companies, you know, 250 people, you know, 50 companies pitching their treatments, you know, to try and get venture capital funding.

And what we have seen over the past decade is a continuous increase in the interest of venture capital to fund these companies. Now it is up to about \$1.5 billion a year across about 120 deals last year. Okay? But the problem that we are beginning to see—

Mr. FATTAH. That is what Potomac was saying, that, if America misses the boat here, you know, it is kind of lights out, that this is like the area in which, the next wealth-building phase in the world is going to operate in.

Mr. LYNCH. I couldn't agree with you more. Humanity has progressed through an agricultural revolution, an industrial revolution, and we are in the midst of an information revolution.

And the next revolution, the technological revolution that will transform how we all work, live and play on a daily basis, will be the neurotechnology revolution. It will impact our laws, how we do marketing, how we entertain ourselves, how we treat each other, how we provide new ways for people to experience life, and it will impact every industry in different ways and create new industries like “neurotainment”—right?—completely new forms of entertaining far beyond the therapeutic impact that it will have.

Mr. FATTAH. One of the other jurisdictions we have is the Commerce Department. So I have spoken with the Commerce Secretary when she was here about Commerce developing a neurotechnology focus so that we could make sure that American industry is focused on this trade space and ways that we need to, and she has agreed to do that.

So thank you very much, Mr. Chairman. I yield back to you.

Mr. CULBERSON. I think a big part of this is the cognitive computing, I guess, that you mentioned earlier.

Let me ask Dr. Olds, if I could, on behalf of the National Science Foundation, to talk to us about the number of grant proposals you receive in the neuroscience discipline.

And of those that you receive, how many does the NSF fund? Just ballpark. And give us a—Mr. Fattah and I an idea of where the most productive areas might be for us to help you target.

Dr. OLDS. So I can give you now ballpark numbers on the number of awards that we have given per year. So from 2009 to 2013, when we were spending approximately \$70 million a year, we were making on the order of 150 to 200 awards per year.

In 2014, we awarded in the neighborhood of 250 awards. In 2015, this year, we expect to award something like 300. And if the appropriation that the President requested for 2016 comes through, that would be about 400 awards.

On the number of proposals, I would need to get back to the Committee on that, and I will.

Mr. CULBERSON. Ballpark percentage that you are able to—

Dr. OLDS. I would say we can fund about 20 percent—somewhere in the neighborhood of 20 percent of the proposals.

Mr. FATTAH. Mr. Chairman, you were asking about breakthroughs earlier. Let me interrupt your train of thought and tell you I was.

Mr. CULBERSON. Oh, please. That is the benefit of this. It is free flowing.

Mr. FATTAH. Something that you will be excited about.

So Keith Black, who is the head of neurosurgery at Cedars-Sinai, was doing some research that showed that you can use a part of the venom from a scorpion that will only attach to non-healthy cells in the brain, and it allows the surgeon to now just go in and pluck out the tumor that otherwise is hard to discern.

So this is where nature, you were talking about God's sense of humor, whereas nature—there is a lot going on out there, but this was a fascinating piece. I knew you would be.

Mr. CULBERSON. It is fascinating.

Mr. FATTAH. So I wanted to share that with you. I am going to send you the paper. They are doing the clinic trials now. So it is working out quite well.

Mr. CULBERSON. Right.

Mr. FATTAH. So they can, you know, and Senator Kennedy, we know lots of people who had these brain tumors not to a good result.

But this particular technique enables the surgeon by utilizing something called chlorotoxin 35, which is part of the venom from an actual scorpion spider. It kind of lights up the runway, you know, for the snippers to come, you know.

Mr. CULBERSON. Fascinating. It is extraordinary. And the advances come from you all sparking off each other; so, I know how important the collaboration is.

And you really often don't know where the advance is going to come, and it is up to the Federal government to invest in this basic research because the private sector just—either cannot—they just simply don't have the resources. You can't stay with it. You have got to make sure your shareholders' expectations are met in the shorter term.

So it is up to us to invest in a lot of these. It may just turn out to be dead-end rabbit trails, but otherwise wouldn't get done.

I wanted to ask Dr. Olds about supercomputing. And National Science Foundation had funded Blue Waters, one of the most powerful supercomputers in the world.

And, if you could, talk to us about how this resource is being used to support brain research. And how is the United States holding up in the ongoing effort to build the biggest, fastest, best computer on Earth?

Dr. OLDS. So—

Mr. CULBERSON. The Japanese leapfrogged us, I know, recently, but that is—I just want to make sure we are the ones standing at the cutting edge of that work.

Dr. OLDS. So thank you for the question. That is two questions. I am going to answer the first one first and the second one second.

Blue Waters, of course, is one of the most powerful supercomputers in the world and is hosted in Illinois at the National Center for Supercomputing. In the area of neuroscience, it is being used in a number of really exciting areas. One is brain imaging, where it is improving the resolution of blood flow imaging, which is really important in diagnosing stroke and ischemia in the brain.

It is also being used to elucidate the structure of ion channels, which Dr. Hyman mentioned earlier. These are critically important. These ion channels have three-dimensional shapes, which is critical to their function and how they interact with neurotransmitters and drugs. And so Blue Waters is being used for that.

It is also being used to simulate and model the process of vesicle fusion to the membrane presynaptically—that is involved in neurotransmission. If you don't have a neurotransmitter being released from the membrane, then you do not have communication between cells.

And then, to me, one of the most exciting areas that Blue Waters is working on has to do with gene expression in the brain in the context of Alzheimer's disease.

We have been talking about misfolded proteins in Alzheimer's disease, but, really, the important thing to think about Alzheimer's disease is that there are about 8,000 brain-specific genes that are expressed in the brain, and these genes—you can think of their expression across all the brain cells as being a dynamic network which is under exquisite control.

When we are healthy, that network is operating in one mode. When we have a disease like Alzheimer's, it is operating in another mode that may require supercomputing to actually understand. So

Blue Waters is being used in that context, and I think that is really important.

Getting back to the question of how we are doing in terms of supercomputing, I would just go back to what Mr. Lynch was talking about.

You know, we have a proof of concept—an existence proof in the human brain—that we can have real high-performance computing, exascale computing, if you will, functioning on 20 watts of electricity.

So there is something about the architecture of what is in here that is fundamentally different from what is in, you know, the laptop computer. If we could understand that, I think it would be a gigantic step forward in terms of having a permanent lead in high-performance computing.

Mr. CULBERSON. Well, how do we deal with the—once the computer becomes self-aware and can learn—you mentioned cognitive computing—it opens up all kinds of wonderful possibilities, but, also, terrifying possibilities as well.

Talk to us a little bit about, if you could, each one of us, some of your personal concerns about how we are going to deal with that when we cross that threshold. You know, some of the greatest minds in the country continue to talk about the concern about AI, that it may not be a happy experience.

Dr. HYMAN. Mr. Chairman, I think there are a lot of technologies that we focus on all for benefit with therapeutic purposes to solve important engineering problems that have other uses that we wouldn't be so happy with or that we worry might get away from us.

And maybe the earliest experience of this country in thinking about that is nuclear proliferation, which is, after all, knowledge of certain advanced technologies. And we can see the challenges there, but I think the challenges are going to be even greater because these are going to be widely disseminated not-classified technologies.

And one of the things that I have actually been involved in is to help people thinking about inventing these technologies, not—not AI, but invasive deep-brain stimulation for regulating behavior.

So DARPA has these very interesting advanced projects really aimed at servicemen and -women who have traumatic brain injury, post-traumatic stress disorder, but, also, chronic pain syndromes who may have become addicted to pain medicines because of their injuries.

And as an alternative to waiting for the development of new medications, they are studying the ability to directly stimulate circuits in the brain, something that has worked very, very well for Parkinson's disease.

But they understand that, once you are stimulating brain circuits, you know, this could be a good and therapeutic thing, but it also could change personality, personal identity.

So they have appointed an ethical, legal, and social issues panel to help them oversee this research that I am privileged to serve on, and they take it quite seriously. But I think it is a kind of model.

The Genome Project did that. They had an ethical, legal, and social issues panel that actually Jim Watson, James Watson, had ini-

tiated. And the idea here is not to stop these technologies because they have so much benefit, but, really, as a community, to think through the really difficult problem of maximizing the benefit, but somehow controlling the risks.

Mr. FATTAH. It is kind of like not to minimize, but it is just like everything else. I mean, it is like the automobile. You know, if used for its purpose, fine.

And that is why I think OSTP at the origins of this effort with the Interagency Working Group put together a ethics group. I know the president, Amy Gutmann, was involved and some others.

So, you know, it is a big concern. However, as Newt Gingrich said, it is the larger challenge for the country. If we can't delay Alzheimer's by 5 or 6 years, you know, we are going to go bankrupt.

Mr. CULBERSON. Well, I am not questioning that.

Mr. FATTAH. We have got to figure out our way forward and we have got to make sure that people don't misuse the technology.

Mr. CULBERSON. You know, that is why we are here. Very supportive of the work. But I just think, with your talent at this table, it is important to talk about the ethical challenges and what would lie ahead for the human race if we actually develop a computer that is able to function at the level of the human brain, can learn a task—

Mr. FATTAH. But to get closer to your line, there are issues here that are useful for us from an intelligence standpoint and other things for national security that are also beneficial and is closer to the line you are concerned about, but have some utility.

Mr. CULBERSON. Well, that day is coming soon. And we have got a panel of great talent here. I just want to get your thoughts about AI and cognitive computing and what are we going to do when we hit that threshold.

Mr. LYNCH. Sure. I mean, with any new technologies, there is both promise and peril. And we need to have extreme vigilance as these technologies come to market and are being researched.

I personally know right now that IBM, Facebook, Google, HP, Qualcomm, all the major chipmakers around the world, some of the major software companies, are hiring neuroscientists because they see the competitive advantage that brain-inspired computing can actually bring to their organization.

So, in a way, you know, the cat is kind of out of the bag, and we need to have these public conversations around, "What are the limits to these technologies? And how do we design them in initially?"

Mr. CULBERSON. Right. They just called a vote, and I want to let Mr. Fattah close up.

But I really would also like to ask about what is this device and the instant gratification that it brings doing to our kids and the evolution of our minds.

Because this is changing us. And the human instinct for instant gratification—you see the Google searches. If people don't get what they find within a few nanoseconds, they are switching. It is altering behavior, and I think it is really worrisome.

Can you talk to us a little bit about that, any one of you who want to dive in.

Dr. OLDS. So Nicholas Carr wrote an article recently. I think it was called *Is Google Ruining Us?* And——

Mr. CULBERSON. Well, in particular, these things.

Dr. OLDS. Right. And——

Mr. CULBERSON. Sometimes I want to hit it with a hammer.

Dr. OLDS. I think that he raised the point that, as we become used to answering questions instantly without thinking about them intellectually, that would change the plasticity of our neural circuits and, potentially, would produce some long-term change.

As I told Mr. Carr at the time he was researching his book, I would be skeptical about that and I think we really need to actually look at the evidence very carefully with regard to long-term changes in human brains as a result of the IT revolution that is going on.

Mr. CULBERSON. Physical changes. What about behavioral? Then I want to let Mr. Fattah close up on this. But, I mean, he has gotten me on another question.

But it worries the heck out of me because you don't see kids playing in the yard anymore and looking for bugs or doing things like all normal kids should be.

Dr. OLDS. I agree.

Dr. HYMAN. I mean, you are absolutely right. And, again, we have got—we are not very good at having broad conversations about how to control the downside of technologies where we are all too good at sometimes having deadening regulation. You know, you are not going to outlaw, you know, email or iPhones, but we have to deal with cyberbullying. Right?

And so I think we really need to have more serious conversations that somehow affect the way society handles these issues or things that are really beneficial and wonderful will then have very much unintended consequences.

Mr. CULBERSON. But you are seeing changes in human behavior with this instant access to information and gratification——

Dr. HYMAN. Yeah. Absolutely.

Dr. OLDS. If I may, I think this is an example of why we need research in social, behavioral, and economic sciences as well as the basic biological research, because this is an area, clearly, where we are looking at complex human behavior as it interacts with machines. And that would be SBE.

Mr. CULBERSON. That is a social behavior headline no one wants——

Mr. FATTAH. Let me jump on the more positive side of this for a minute.

So, you know, I was out in the Napa Valley, the Staglins. They had a son who had some challenges with schizophrenia. And since that time, he is doing great, but they engaged themselves in this effort and raised a lot of money, over \$250 million of private money, particularly for schizophrenia-related research. And they fund early investigators.

And part of what seems to be emerging as part of some of their research is that some of this gaming activity can be therapeutically useful and that part of the challenge—it is not the totality of the challenge—but part of the challenges of some of these young people. It is almost always young people who face these schizophrenic

circumstances and almost always boys, not in every circumstance, but more so than not just getting the brain functioning slightly more efficiently by activity actually provides some benefit.

And then I was out in Tom Cole's backyard at the University of Oklahoma's, got a program called a center called K20, and they were developing these games that my teenager likes, these sim games, but imbedding in the game, you know, things that we would want, you know, interest in STEM education and going to college and, you know, hiding these notions in nuanced sort of ways inside the game so that even the kids are playing them they are getting indoctrinated with positive messages.

So I think, you know, some of this we are going to have to run with and just try to improve as we go, Mr. Chairman.

But I do want to, as we go to wrap up, I want to thank the chairman again because it is not the norm in a majority-minority situation that there would be a hearing like this, and I want to thank you.

But it just shows that the interest in this matter is not partisan and we intend, you know, well beyond this administration, which has got, you know, 20 more months and has done some important work—but this is work that we are going to be engaged in for a long time going forward that we need to deal with.

And we need to do it on all of the fronts. We didn't talk a lot about traumatic brain injury today, but we have close to 3 million Americans—and I am not talking about servicemembers now—3 million—a lot of them young people—not all of them—but, you know, riding their bikes, playing games, who end up with very serious injuries.

And the things that we thought we knew about traumatic brain injuries in the past we now know differently, and there is a lot more that can be done. And this is an area where we want to do, that we need to, also look at because it is very different from the disease side.

These are actually, we had our own colleague who was shot in the head, Congresswoman Giffords, and, you know, in past circumstances, you wouldn't see the kind of recovery that has happened. But, you know, it is because of the great work that is being done. But we need to work in this space more.

And I know that the chairman and I did work on this on the veterans' side, but this is on the civilian side, it is a very important issue, too.

So I want to thank the chairman and I want to thank our guests.

Mr. CULBERSON. This is a team effort.

Mr. FATTAH. It is a team effort, and we are going to keep going. All right.

Mr. CULBERSON. It so important, and it is something we are arm in arm on, as I have been a member of the subcommittee since I first got on Appropriations in 2003 and always dreamed of having the privilege of being able to chair it to be able to help make sure that these—as Mr. Jefferson said, he liked the dreams of the future better than the memories of the past.

And I will continue to do everything I can to help make sure that these dreams of the future come true from our work that we do arm in arm——

Mr. FATTAH. Together. Right.

Mr. CULBERSON [continuing]. And remembering, also, that Mr. Jefferson liked to say that liberty is the firstborn child of science, which is absolutely true.

So it is exciting and so worthwhile. And we will continue to work together, Chaka, to make sure that we are providing you the research, the support that you need, and get out of the way as much as possible.

Because, as a Texan, we also understand that the less government, the better, and get out of the way, and particularly when it comes to the sciences, let you follow the facts.

Mr. FATTAH. And let me thank OSTP for shepherding this, and you have done a great job, Dr. Rubin and Dr. Hogan and the team there, because this is a massive enterprise stretching across both the government and the private sector and private foundations and academia and hospitals. I mean, there are just a lot of people, including people focused on ethics, who have to be part of this. So thank you and——

Mr. CULBERSON. Thank you for making this happen.

Mr. FATTAH. Somehow I think we might be having another hearing on neuroscience next year this time in the appropriations process.

Thank you, Mr. Chairman.

Mr. CULBERSON. Maybe a lot sooner.

Thank you very much.

And the hearing is adjourned. Thank you.

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