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**SPACE SITUATIONAL AWARENESS:
WHOLE OF GOVERNMENT PERSPECTIVES
ON ROLES AND RESPONSIBILITIES**

JOINT HEARING

BEFORE THE
SUBCOMMITTEE ON STRATEGIC FORCES
OF THE
COMMITTEE ON ARMED SERVICES

MEETING JOINTLY WITH
SUBCOMMITTEE ON SPACE
OF THE
COMMITTEE ON SCIENCE, SPACE,
AND TECHNOLOGY

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**SPACE SITUATIONAL AWARENESS:
WHOLE OF GOVERNMENT PERSPECTIVES
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HOUSE OF REPRESENTATIVES, COMMITTEE ON ARMED SERVICES, SUBCOMMITTEE ON STRATEGIC FORCES, MEETING JOINTLY WITH THE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY, SUBCOMMITTEE ON SPACE, *Washington, DC, Friday, June 22, 2018.*

The subcommittees met, pursuant to call, at 9:01 a.m., in room 2118, Rayburn House Office Building, Hon. Mike Rogers (chairman of the Subcommittee on Strategic Forces) presiding.

OPENING STATEMENT OF HON. MIKE ROGERS, A REPRESENTATIVE FROM ALABAMA, CHAIRMAN, SUBCOMMITTEE ON STRATEGIC FORCES

Mr. ROGERS. Good morning. I want to thank Chairman Babin and Ranking Member Bera for their interest and cooperation in organizing this joint hearing to discuss space situational awareness in a whole of government context.

I also appreciate the interest expressed by members of the House Armed Services Committee and the Committee on Science, Space, and Technology more broadly, and, therefore, ask unanimous consent that non-subcommittee members be allowed to participate in today's hearing after all subcommittee members have had an opportunity to ask questions. Is there objection?

Hearing none, so ordered.

Non-subcommittee members will be recognized at the appropriate time for 5 minutes.

Given that we have an excellent panel of witnesses and lots of member interest, I will ask unanimous consent to include into the record all member statements and extraneous material.

Without objection, so ordered.

Today we will hear from an excellent panel of witnesses on SSA [space situational awareness], including the Honorable Wilbur Ross, Secretary of Commerce; the Honorable Jim Bridenstine, no stranger to this room or this subject matter, Administrator, National Aeronautics and Space Administration; and another person who is no stranger to this room, General John Hyten, Commander, United States Strategic Command.

I will turn it over to you for your brief opening statements and then we will roll straight into questions.

General Hyten, start with you.

**STATEMENT OF GEN JOHN E. HYTEN, USAF, COMMANDER,
UNITED STATES STRATEGIC COMMAND**

General HYTEN. Thank you, Chairman Rogers, Babin, Smith, the three chairmen, Ranking Members Cooper, Bera, Johnson, distin-

guished committee members, all of you. It is an honor to be here today with Secretary Ross and Administrator Bridenstine. It is kind of difficult not to say Congressman Bridenstine, but he is on this side of the table, which is interesting.

So it is always a privilege to be here, and it is a privilege to represent the 162,000 Americans that accomplish the missions of my command every day. So I would like to thank both committees for your enduring support to our Nation's defense and in particular for your work on our national space policy.

My command, U.S. Strategic Command, is a global warfighting command. We set the conditions across the globe as the ultimate guarantor of our national and allied security, and our missions are to deter strategic attack and employ nuclear, space, global strike, joint electronic warfare, and missile defense forces as directed.

To do this, we rely on timely and accurate information about the operational environments we operate in. Space is one of those environments and it is no different than any other. Space situational awareness is how we bring together the multisource data needed for space control and to assess adversary intentions.

Our national security mission demands that we make the space environment as safe as possible to operate in, and that has led to our current sharing arrangements. Today, we take our space situational awareness data and make it available for space safety, but it is not an inherent mission of Strategic Command or the Department of Defense. And I have never believed the Department of Defense should have to perform that space traffic management for the world. We do that because we need to do it.

So for a while now I have advocated to move space traffic management to another agency while retaining the Department of Defense—in the Department of Defense the essential elements of space situational awareness needed for our national security. So I believe transition is a good idea, and I support the actions taken by the President on Monday to designate the Department of Commerce as that lead. It is the right move, and I commit to work with the administration, the Department of Congress and the Congress—the Department of Commerce and the Congress to meet the President's space traffic management goals.

So thank you again, Mr. Chairman, for the opportunity to be here. I look forward to your questions.

[The prepared statement of General Hyten can be found in the Appendix on page 59.]

Mr. ROGERS. Thank you, General.

The Chair now recognizes Administrator Bridenstine.

STATEMENT OF HON. JAMES F. BRIDENSTINE, ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. BRIDENSTINE. Chairman Cooper, Chairman Smith, Chairman Babin, Ranking Member—or I should say Ranking Member Cooper and—Chairman Rogers, I should say, Ranking Member Cooper and Ranking Member Bera, it is great to be back. Thank you so much for having me here. It is an honor to represent NASA here before the Strategic Forces Subcommittee and the Space Subcommittee here in the House of Representatives.

NASA has, of course, very important equities when it comes to space situational awareness and space traffic management. Of course, we have the Human Space Flight Program, and we have dozens of satellites that are delivering critically important science for our Nation and, in fact, for the entire world. So we have a big stake in making sure we get right space situational awareness and space traffic management.

For objects that are big enough to track—of course, we don't do the tracking ourselves and we don't keep a catalog ourselves. We rely on the Strategic Command for that through the JSpOC [Joint Space Operations Center], but the data that we receive from the JSpOC we analyze very closely to make sure that our human space flight activities and our robotic space flight activities are protected and that they remain safe. So this is critical for us.

Objects that are too small to track, NASA has a department, the Orbital Debris Program Office, that is responsible for characterizing that orbital debris, and we characterize it specifically so that we can model ultimately the risk from these very small pieces of debris that are not trackable. And I will be clear, the biggest risk is from objects that are not trackable. That is the biggest part of what we deal with every day when it comes to protecting our assets in space.

And so we characterize, you know, where those debris fields are and ultimately how they could impact our missions and make assessments how much do we need to invest to shield our assets and/or maybe operate in different orbital regimes.

So this is important to NASA. I look forward to working with this committee. I look forward to following the—implementing I should say Space Policy Directive-2 and Space Policy Directive-3 from the President that gives these new activities to the Department of Commerce.

So, with that, I look forward to working with everybody here and thank you for having me.

[The prepared statement of Mr. Bridenstine can be found in the Appendix on page 69.]

Mr. ROGERS. Thank you, Mr. Bridenstine.
Secretary Ross, you are recognized.

**STATEMENT OF HON. WILBUR ROSS,
SECRETARY OF COMMERCE**

Secretary ROSS. Good morning. Thank you, Chairman Rogers, Chairman Babin, Ranking Members Cooper and Bera, and both subcommittees, for allowing me to address you today. I would also like to thank Chairman Lamar Smith, Chairman Thornberry, and Ranking Members Johnson and Smith for your work on this important issue. Your continued support of this administration's space policy vision is greatly appreciated.

In addition, I thank my esteemed colleagues General Hyten and Administrator Bridenstine for joining me on this panel. It is a pleasure to work with all of you—decision makers, leaders, and enablers of U.S. space commercial and defense policy. Your work is imperative to the future achievement and well-being of the United States.

The Trump administration and the Department of Commerce are creating more opportunities for the space community to develop and thrive. In just 6 months, President Trump has signed three Presidential space directives. The first calls for human expansion across the solar system. It is about time. The second sets a schedule for streamlining regulations to unshackle commercial activity in space.

Commerce is already advancing ambitious regulatory reform. Over the last year, we have worked with Department of Defense, State, Department of the Interior, and the Director of National Intelligence to reduce commercial remote sensing application timelines by about 50 percent from where they were before. We have cut what was 210 days down to an average of 91 days.

The President's third space policy directive, signed at this week's Space Council meeting, establishes the country's first comprehensive national space traffic management policy. The directive emphasizes safety, stability, and sustainability, foundational elements to successful space activities, and it names Commerce as the new U.S. Government interface for space traffic coordination.

This new policy directs the Department to provide a basic level of space situational awareness data for public and nonpublic use, based on the space catalog compiled by the Department of Defense [DOD]. This change will better enable DOD to focus on its national security mission.

Commerce is eager to provide that service to industry, to facilitate continued commercial development in outer space. As the friend-of-business agency and not a typical old-fashioned regulator, we are the perfect agency for the job. Unlike in past generations, activity in space is becoming largely commercial. Commerce already engages with private space companies on export control, spectrum issues, remote sensing licensing, and trade promotion. And we already manage, with NASA's great support, the government's largest operational civil satellite fleet, 14 NOAA [National Oceanic and Atmospheric Administration] satellites and 4 for the Air Force. We also have the National Institute of Standards and Technology, which has a proven track record of working with industry to conduct research and to define scientific standards for business needs.

We are looking forward to taking on this new role of space traffic coordination. The need for timely and accurate and actionable SSA data and STM [space traffic management] services has never been greater. DOD currently observes well over 20,000 objects circling the Earth, many of which are softball-size or larger pieces of man-made space debris. These objects fly around Earth at dangerous speeds of up to 17,500 miles per hour, about 10 times the speed of a small bullet. Even more concerning are the estimated 600,000 smaller objects that could still cause significant harm if a collision occurred.

Congestion in space will only increase. In the next few years, the number of American satellites in space will likely grow from 800 to over 15,000. As more and more objects get launched, effective space traffic coordination and orbital debris mitigation standards will help promote our Earth's orbits from further congestion.

With the growth of space commerce and DOD's focus on national security, President Trump and the National Space Council determined that Commerce should become the new civil agency interface. With this role, Commerce can incentivize innovative space services, based on an open architecture data repository. This repository will establish a mechanism for SSA data sharing that will enable/enhance STM services that will empower greater industry-provided data and services. Involvement by industry, academia, and other stakeholders is paramount to the success of this endeavor, and it will take a whole of government approach to face this challenge.

Working with NASA and DOD, Commerce is committed to facilitating these discussions and implementing their results so that the United States can provide global leadership for space traffic standards. America must continue to be the leader in space. Space traffic coordination is an important task, and Commerce has dedicated serious deliberation and planning in its execution. We have an excellent relationship with our partners and we will continue working with them to carry out the implementation plan approved by the National Space Council.

The administration is setting clear milestones and will be transparent about achieving them. Commerce takes on this new responsibility with several goals in mind. We will be dedicated to creating economic growth and sustainable development in all industry sectors.

Facilitating space traffic coordination will provide the space industry with more tools to be successful. Commerce will also work with industry to find ways to enhance space traffic coordination data and be more adaptive to industry concerns.

Working with DOD, we will evolve the architecture that currently supports U.S. Strategic Command to be even more responsive to the space industry's needs. And we look forward to working with Congress to protect a safe space environment for future commercial growth.

With Commerce at the helm of commercial space traffic coordination, we will ensure that the growing space industry remains open for business, and America will continue to be the flag of choice for space commerce.

I will be happy to respond to any questions you may have. Thank you.

[The prepared statement of Secretary Ross can be found in the Appendix on page 76.]

Mr. ROGERS. Thank you, Mr. Secretary.

I thank all the witnesses for being here and for those thoughtful opening statements and for what you do for our country.

I recognize myself for the first set of questions.

General Hyten, I fully support the President's directive on space management policy, but I do want to make sure that I am clear on this, and I think you touched on it in your opening statement.

Given that space is clearly now recognized as a warfighting domain, are you saying that you don't believe that this unique DOD SSA requirements can only be met by the military, that you believe that they can be effectively met by nonmilitary efforts?

General HYTEN. So the—I really need to be specific on that, because we have to do the space situational awareness mission inside Strategic Command, inside the Department of Defense for the missions that we have to do for national security space.

Mr. ROGERS. And that will continue?

General HYTEN. That will not change. That will not change for as far as I can see into the future, because we have to know that information in order to defend ourselves against potential threats. That is why we started doing this business back in the Cold War days to begin with.

So we are going to continue that, but we don't have to be the public face to the world for—that is what the new decision is, to have the Department of Commerce be the public face to the world.

Mr. ROGERS. That is what I wanted to make clear, and I appreciate that.

Mr. Secretary, you are right about the activity up there. In addition to this roughly 620,000 pieces of debris that you and the administrator have talked about, we have a lot of activity going up and going to continue to be that way. You talked about 600 or so, 600 to 800 satellites now and going toward 15,000.

I know of Boeing and SpaceX in this country that are each talking about putting constellations up for broadband capability that can be as many as 2,000 or 3,000 satellites each, just small sats. And I know there is at least one Indian company that is doing the same thing, a couple thousand. That is just going to proliferate, and I have been very concerned about how we are going to manage that.

Tell me exactly how you see this working as far as that traffic management and, more importantly, the debris mitigation that you made reference to. I would open that up for either one of the two of you.

Secretary ROSS. Well, we already are dealing a lot with some of these issues through NOAA, because of its satellites. So we have people already somewhat familiar with this sector. We have planned to send initial delegations out to Vandenberg, out to Omaha to start learning more about the specifics that would be involved. And we are prepared to dedicate people to that and have people from those entities also working at Commerce so that we make a seamless integration.

Hard to predict exactly what the timeline would be, but it is probably something more or less on the order of a year to make a seamless transition between the two.

Mr. ROGERS. Do you anticipate cooperation with countries like China and the companies therein and companies in India that are going to also be concerned about this activity?

Secretary ROSS. Well, yes. We, as you know, have a very international map to both our activities and our physical presence. And parts of our activity, such as the ITA [International Trade Administration], the promotion entity that has created some \$3 billion of space business already, NIST [National Institute of Standards and Technology] works with just about every country in the world in evolving standards. And standards and getting them agreed with other countries is clearly a very important part of this activity.

Mr. ROGERS. Mr. Bridenstine, how would debris mitigation work functionally? I just don't know. I don't have a clue.

Mr. BRIDENSTINE. So a couple of things. You mentioned earlier, Chairman Rogers, that there were going to be these constellations of potentially thousands of satellites in low Earth orbit for the purpose of communications. That is absolutely true.

Where NASA is right now, we participate in what is called the Interagency Space Debris Coordination Committee. When this committee hears the word "interagency," you think of within the U.S. Government. When we talk about the Interagency Space Debris Coordination Committee, we are talking about space agencies from around the world.

And this interagency committee includes 13 different space agencies across the world. And what this organization has determined is that every 5 to 9 years, if launch cadences stay the same and the orbital debris fields stay the same, every 5 to 9 years we are going to have a collision in low Earth orbit similar to the Iridium-Cosmos collision that we saw back in 2009 that created thousands of pieces of orbital debris. Now, that is if launch cadences stay the same and constellations don't grow. In fact, we are seeing just the opposite. Launch is going to be happening a whole lot more frequently, especially if I am successful doing my job as the NASA administrator. We are going to see a lot more launches. We are going to see a lot more activity in low Earth orbit. So these kind of collisions beget even more collisions.

So we have to be very careful that we don't let this eventually run away. And I am not saying that we are even close to that right now, but we need to be thinking the next 50 years, 100 years down the road, especially as we take more advantage of space.

As far as how NASA deals with a lot of the—you mentioned the word "mitigation" challenges. NASA sets standards to prevent new orbital debris from occurring. So when a spacecraft gets launched and then it separates from its upper stage, sometimes that can result in debris. And so we set standards for ourselves as an agency to limit that kind of activity so that we prevent or we limit as much as possible the danger from space debris.

Those standards then ultimately get promulgated throughout the rest of the interagency within the U.S. Government. So the Department of Defense follows those standards. NOAA follows those standards, other agencies that utilize space. And eventually, it got to the point where now those standards are, you know, required for commercial operations as well and, of course, promulgated throughout the international community.

So NASA has led on this. I will be clear that not all the countries follow the same standards, so that is often a challenge, but I do believe it is important for us to lead and that those standards could eventually get to a point where there is enough international pressure that around the world countries will have to follow those standards.

Mr. ROGERS. Great. Thank you very much.

The Chair now recognizes the ranking member, Mr. Cooper, for any questions he may have.

Mr. COOPER. Thank you, Mr. Chairman.

I too would like to welcome the witnesses. I appreciate Mr. Bridenstine's chart here. I think that is very helpful in helping us understand the debris problem. I am worried, though, that the chart underestimates the difficulty. As you point out in your testimony and Secretary Ross does as well, we have some 600,000 pieces of very tiny debris to monitor, because each one of those pieces could be deadly.

General HYTEN. That is right.

Mr. COOPER. And as all the witnesses said, this problem is only increasing and it is probably increasing exponentially. So right now as we are offloading the priceless work the Air Force has been doing for space traffic management, right now we are reaching the acute phase, the urgent phase for the entire planet when, as Secretary Ross pointed out, a large percentage of today's space debris is the result of just two collisions, just two, and how there are going to be thousands and perhaps tens of thousands of collision possibilities. And as the Secretary also pointed out in his testimony, each one of these could lead to a devastating chain reaction of creating yet further debris, which could tax the power of even the fastest supercomputer to monitor all these orbits and trajectories and speeds and things like that.

So a simple question: Should we punish nations or companies that cause satellite debris? It is one thing to use carrots. Are we also going to consider sticks? To each of the witnesses.

Mr. BRIDENSTINE. Ranking Member Cooper, within the Outer Space Treaty, nations are responsible for what they do in space. There is a liability that nations have for these kind of activities. Unfortunately, if you look throughout history, some very nefarious activities have happened in space.

On your subcommittee, we talk about the 2007 direct ascent anti-satellite missile launched by China that hit one of their own weather satellites and created an orbital debris field of thousands of pieces that we are, in fact, still dealing with today in low Earth orbit. The challenge that we have is enforcement at the international level. It is a big challenge.

So certainly we have seen activities change, based on international pressure, but we haven't seen really any enforcement as far as liability, anybody paying the price for the damage that they have done to low Earth orbit.

Mr. COOPER. Let's make it a U.S.-only issue. Should we punish a U.S. company that causes needless space debris?

Mr. BRIDENSTINE. That is a good question, sir. I would like to take that for the record, maybe get back to you on what a good approach on that might be.

But certainly—and I think you are aware of this keenly—we want to maximize the utility of space. We want commercial companies to have access and availability. And if they are not, in fact, following the rules, we could deny access to space for everybody altogether, which would undermine our ability to maximize the utility of space. So there should be some kind of legal regime, yes, sir.

Mr. COOPER. My time is limited with all the other members here, but there is the attribution problem. NASA currently has a statistical model to track these 600,000 pieces. How do you tell a satel-

lite company or, worse, an astronaut that they died or were killed because of a statistic? People will want attribution.

If you have enough data to form the model, then there must be some reasonable source for that data. So we have got to figure this out, because the 600,000 pieces you are tracking today could be tens of millions or billions shortly.

Mr. BRIDENSTINE. Yes, sir. Attribution is critical, and some of the new technologies that are being developed right now could help us to attribute, you know, a piece of orbital debris that caused somebody's loss of life to a specific nation or company. That is a challenge going forward for sure.

Mr. COOPER. Thank you, Mr. Chairman.

Mr. ROGERS. Thank you. The Chair now recognizes Chairman Babin for any questions he may have.

Mr. BABIN. Thank you, Mr. Chairman.

Thank you, witnesses, for being here too.

Secretary Ross, I would like to start with you, if you don't mind. I would like to start by stating my support for the President's Space Policy Directive-3. And while I am at it, I support 1 and 2 as well. In Congress, we have a responsibility to protect the taxpayer. Government spending and bureaucracy is a serious concern. However, not improving the Nation's civil space situational awareness and space traffic management framework is unacceptable.

What steps will be taken to protect against unnecessary spending and how much funding will be needed to carry this policy out?

Secretary ROSS. Thank you for that question, sir. This activity will report to the regulatory reform officer at Commerce. And as you may be aware, we have already dismantled 65 regulations, which is more than any other Cabinet department.

So we are keenly aware of the importance of reducing bureaucratic burden, both in terms of direct taxpayer expense and in terms of the burden unnecessarily placed on industry. So that will be one of the activities we have very, very much in mind.

Mr. BABIN. Okay. Thank you. Then the next question for Administrator Bridenstine, NASA has substantial technical expertise relevant to improving space situational awareness and space traffic management. For example, Johnson Space Center is home to the world-renowned orbital debris scientists. Under SD-3, how will NASA leverage its expertise to further our national SSA and STM efforts?

Mr. BRIDENSTINE. It is a wonderful question, Chairman. So under Space Policy Directive-3 and the implementation guidance, NASA is directed to lead a research and technology effort that takes advantages of the capabilities that we already have, but also make investments to improve on those capabilities and technologies.

I think our biggest area of focus historically has been investing in characterizing the orbital debris population that cannot be tracked because it is too small, and then assessing risk based on that orbital debris population. And, of course, Space Policy Directive-3 is going to take it a step further and give us authorities to ultimately make investments to do space situational awareness or, you know, potentially, you know, creating an environment—kind of the way I see NASA being involved.

I will just start over here a little bit. Kind of like the way NASA does unmanned aerial systems traffic management, we don't want to be involved in doing unmanned aerial systems traffic management for the United States of America and integrating UAVs [unmanned aerial vehicles] in into the airspace. That is not the job of NASA. But what we can do is we can do the technology demonstrations, we can do pilot programs, we can do the research, and then ultimately take all of what we learn and hand it over to the FAA [Federal Aviation Administration], which is the way NASA is dealing with UTM, unmanned aerial systems traffic management, right now.

I think going forward, under Space Policy Directive-3, we are going to be charged with the same thing, maybe doing pilot programs, demonstrating technology, and then ultimately handing it over to Commerce, which will have the lead on space situational awareness and space traffic management in the future.

It is also true that NASA will not be creating data. That is ultimately not what we do. Of course, the Air Force or I should say Strategic Command creates data through the JSpOC, and then that data could be provided to Commerce. It could also be provided to commercial partners. And then the data that Commerce has would be augmented probably also with commercial partners.

And what NASA can do is ultimately test a lot of the technologies, test the data, and then ultimately implement a plan to help Commerce lead the effort.

Mr. BABIN. Great. Okay, thank you.

And then, General Hyten, the DOD and in particular the Air Force has proposed a significant increase in their space capabilities with the fiscal year 2019 budget. Would you talk a little bit about these capabilities that this increased investment will provide and how they will enhance your warfighting mission?

General HYTEN. Mr. Chairman, I am a combatant commander, so the specific answer can come from the Air Force. But as a combatant commander, I do advocate for those capabilities.

And I am very aware of what the Air Force has put in the budget, and I am pleased with the improvements the Air Force has made in the budget, because those improvements come in a number of different ways. For the purpose of this hearing, a lot of those improvements are in space situational awareness.

The Air Force now has a joint program with the National Reconnaissance Office called Silent Barker where, instead of having two programs on two different sides of the national security space business, there will be one. That one program will improve our situational awareness of the geosynchronous orbit in a significant way.

We are also producing the Space Fence. The Space Fence will come online in 2019. That capability will allow us to see hundreds of thousands of objects that we don't see today. That data will be critical to our mission in the Department of Defense, but we can also provide that to the Department of Commerce and NASA to allow this broader piece to happen.

And then, broadly speaking, what you see in the budget is an improvement of our ability to defend ourselves against threats in space. What you see is a change of our architecture from a large status quo structured approach to a more resilient survivable capa-

bility that can defend ourselves in the future. And then you see in the classified world a lot of work being put to make sure we have the ability to defend ourselves if we are attacked.

Mr. BABIN. And then right along those same lines, how will the establishment of a civil SSA program at the Department of Commerce benefit DOD and continue to protect national interests?

General HYTEN. So we talked about the Iridium-Cosmos collision in 2009. I was the investigating officer of that collision. And one of the things we realized—and General Chilton was the commander of Strategic Command at the time. And when I briefed him, we kind of came to the realization that we are going to have to do this flight safety mission ourselves. And we had to take about a hundred airmen, a hundred military people off of other missions and put them on that in order to do that mission.

Now, we have become a little more efficient as we have gone through the years, because we have been able to improve our automation and capabilities, but we still have dozens and dozens of airmen that do that all the time. When we move that now into the Department of Commerce, we still have to do the job for ourselves, but we will be able to free up those airmen to focus on the war-fighting missions that we need to worry about. That is what we get out of this new approach.

Mr. BABIN. Yes, sir.

And then finally, Secretary Ross, Space Directive Number 3 states that basic space situational awareness and space traffic management services should be provided free of direct user fees. And just to clear up some concern and questions, what services are considered basic and what are some examples of services that go beyond basic?

Secretary ROSS. Well, thank you. We can use the same definition of basic services as has been used historically. We don't see any reason to change that. But a major function will be an open architecture approach to it. Commerce is directed to build that under SPD-3 [Space Policy Directive-3] to incorporate DOD and NASA information with information from international partners and commercial operated data. So it will be a two-directional set of communications, and that will create an enhanced space situational awareness picture.

Mr. BABIN. And then how about the basic—what is considered—what would be considered beyond basic?

Secretary ROSS. Well, the idea of open architecture. Right now, there is not an open architecture. It is a one-way communication channel. We think there is merit to having inputs with information from international partners, as we do right now with the National Weather Service. We coordinate with lots and lots of other government entities in other parts of the world, and that is a very important part of our activity.

Mr. BABIN. Okay. Thank you.

And I yield back, Mr. Chairman.

Mr. ROGERS. Thank you, Mr. Chairman.

The Chair now recognizes Ranking Member Mr. Bera for any questions he may have.

Mr. BERA. Thank you, Mr. Chairman.

And obviously, this is an incredibly timely hearing. Before I ask my questions, I also just want to be clear that we have not made a decision, this body, Congress, as to where space situational awareness should be housed. So that is not an administrative decision; that is a congressional decision.

And Secretary Ross, with all due respect, I don't want the Department of Commerce to start making those plans, because, as has already been raised in each of the testimonies, this is incredibly important as we go forward.

Now, I think it is important, you know, under the leadership of both chairmen, of HASC [House Armed Services Committee] as well as Science, Space, and Technology, I know Chairman Smith, Chairman Babin, the Ranking Member Johnson, we have been talking about this quite a bit and we have got to get this right. It is better to get it right, because this is the 21st century. We have to make sure that DOD has everything that it needs to continue to do the important work of protecting our vital assets in space.

And, you know, as Administrator Bridenstine has already pointed out, we don't want to stifle the innovation in the commercial sector. We don't want to stifle the interest in the international community. But we want to do this right and we do need that, for lack of a better way of describing it, air traffic control cop that is going to, you know, put everyone in the right lane and, you know, to the best of our abilities prevent accidents from happening in space.

You know, it really does have the possibility of transforming what the 21st century looks like. So, you know, again, this Congress, as a deliberative body, has oversight over, you know, what situational awareness looks like in the 21st century. I appreciate the interest of the President and the Vice President, the Space Council, and your interest, Secretary Ross, but we have got to do our work and we are not abdicating that responsibility.

So, Secretary Ross, if we are looking at housing situational awareness within Department of Commerce, there is a lot that has to go into this transition. What kind of resources are necessary? What kind of oversight? How do you share information that only the Department of Defense is probably going to be able to see? How do you make that publicly available? How do you make that internationally available?

I would ask, are you prepared through your department to present an implementation and transition plan to Congress and to this body?

Secretary ROSS. We certainly would if and when we are authorized to undertake the function. But we already, as I mentioned, we disseminate to the public about 40 percent of all the factual information emitted by the administration. So we are very used to packaging information, getting it to the right place, getting it in the right format for people to use.

And one example is space weather is, as you know, a very major factor in this whole situation, because of the impact it has on things that are orbiting around. Well, we are already keenly involved with space weather through our space satellites that are part of the National Weather Service. So we are already into that aspect of it and in a very good position, for example, to integrate that with these other activities.

Mr. BERA. Well great. As my colleague from Colorado, who is helping us push a space weather bill through Congress, it might sound really geeky or wonky, but incredibly important since all of the technology that we rely on, GPS [Global Positioning System] technology, et cetera, not just our military but everyday consumers and individuals.

General Hyten, we have put a lot of responsibility on the DOD and the Air Force, and the DOD has done a wonderful job kind of monitoring; and, you know, it is time that we relieve you of some of that burden for the international world and the commercial sector.

From my perspective, as we go through this transition, there still are going to be unique capabilities that only the DOD has and only the DOD should have. We will have to think through how that information gets passed on to NASA or to Commerce or Department of Transportation. And as you are thinking through this, do you have any thoughts of what we should be thinking about as a deliberative body?

General HYTEN. So a couple of thoughts. So I think from the largest perspective, we have to make sure that as we go forward in the future we always have the ability to make sure we understand what our adversaries are doing. That means we have to have exquisite situational awareness of exactly what is happening on a real-time basis. That is why you have authorized significant amounts of taxpayer dollars to be put against this problem.

As we go into this different sharing arrangement, though, I think the first rule that comes to mind is the first rule of wing walking, and that is you don't let go of the strut until you have good hold of the next strut, which means we can't let loose of, you know, what we have now and what we are doing until we know what is on the other side.

SPD-3 says for the future, the Department of Defense is responsible for providing the authoritative catalog for our country. That means the catalog will come out of the Department of Defense. Now we have to push that into Department of Commerce, into NASA, into other places.

We are going to look with open eyes at how we do that, what the way is that we do that, are there better ways to do that. I think you will see things as we go through the coming year of different ways to do it. But, again, don't let go of the one strut until you got hold of the next one.

Mr. BERA. And I share that sentiment. Let's hold onto that strut. Let's think in a deliberative fashion what this looks like. Think through all the different scenarios and then come up with the right decision. Better to be deliberative about this and get it right as opposed to be hasty about this.

Administrator Bridenstine—and, Jim, it is good to see you on that side of the podium—I know we share a mutual interest in, you know, allowing the commercial sector and recognizing the importance of space, but I think we also share a value, and I think all of us in this room share this value that the world is best served with American leadership, and, you know, that translates to space as well.

And, you know, I do think, you know, in how we look at the world, NASA is going to be critically important as we address this framework. Because it is not just a domestic issue; this is an international issue. And let's get this framework right and then take it to the international community so it does set that framework.

Do you have any thoughts of what we should be thinking about?

Mr. BRIDENSTINE. Absolutely, Ranking Member Bera. And it is good to be here. Thank you for that. And this goes really to the heart of what Chairman Babin was talking about was what is basic space situational awareness data? What is that? Because it is very clear in SPD-3 and the implementation guidance that that needs to be without fee, and the question is why. And as you mentioned, American leadership here matters.

So we need to have, in my view, some basic SSA data available for free, because then when people all around the world are making investments, making determinations where they are going to invest their money to do space activities, they are going to make that determination in the United States of America, because we will have a regime that provides safety and security for their investments and at the same time is without fee. So that attracts capital to the United States. It keeps us in a preeminent position.

Now, there will be debate about the fact that some people would like to see commercial companies—and this would be a good thing and I support it. Some people would like to see commercial companies providing the space situational awareness and space traffic management. We could have a regime where maybe Commerce were to license commercial companies to do that activity, and then before you launch you have to prove to Commerce that you have purchased or bought a subscription to one of those commercial companies providing SSA and STM.

So that is a model where you would have a competitive market to provide more data and better data, with multiple [SSA]/STM providers all licensed by Commerce, but at the same time we get back to what is that basic [SSA]/STM that would be provided without fee. And this is going to be a balance, because ultimately we want people to make investments in the United States of America, and at the same time we want a commercial competitive marketplace where these providers of STA and—SSA and STM, they are competing to provide more data and better data at a lower cost, driving down insurance rates, all those kind of things.

So this is not going to be an easy thing, as you have already identified, but here is what I think all of us believe. It has to be done, because what is at stake is so important right now.

Mr. BERA. Great. And with that, I yield back.

Mr. ROGERS. Thank you, Mr. Bera.

The Chair now recognizes Chairman Lamar Smith for any questions he may have.

Mr. SMITH. Thank you, Mr. Chairman.

First of all, let me say that it is gratifying to see the cooperation and collaboration between the two committees that has resulted in this hearing today. This may be a first. It is certainly the first in many years, and I hope it will be an example of further cooperation between our committees.

Second of all, it is nice to see a former member of the Science, Space, and Technology Committee as the new administrator of NASA. Jim Bridenstine is the right person at the right time in the right place, and that doesn't happen that often, but it is nice that it happened here.

Mr. BRIDENSTINE. Thank you, sir.

Mr. SMITH. Jim, good to be with you.

Secretary Ross, let me direct my first question to you, and I think this will help a number of members here. Would you go into some detail as to why you think the Department of Commerce is the best agency to oversee the space traffic management?

Secretary ROSS. Yes, sir. First of all, as you know, we have elevated all of the space activities within Commerce into the Office of Space Commerce, which reports directly to me. So rather than being fragmented, rather than being buried in different parts of the Department, we are pulling it all together. That in and of itself will make it more functional, less bureaucratic than it had been.

In terms of specific things that we can do, the ITA has the statutory duty, as does the Office of Space Commerce, to promote and assist this burgeoning space industry. The National Institute for Standards and Technology, which has a very proven record in developing standards and having them adopted throughout global economies, will be very, very involved. NTIA [National Telecommunications and Information Administration], which manages Federal spectrum use for space communications, will also play a very important role in it. And then NOAA, as you know, it already oversees the largest operational space force in the private civil sector.

So those are some of the experiences that we already have. Notwithstanding, we continue to engage with our partners at the Department of Transportation on a variety of issues, and we will be working quite intensely with NASA on the one hand and with DOD on the other hand.

So we already are planning within the next couple of weeks to send, as I mentioned, a delegation to Omaha and to Vandenberg. So we are trying very hard to figure out the proper way to integrate ourselves.

Mr. SMITH. Okay.

Secretary ROSS. The other thing that you should be aware, many companies that don't need a license actually put a camera on their payload anyway to get the license for remote sensing from Commerce. And the reason they do that is it deals with their compliance with the Outer Space Treaty.

So here you have companies volunteering to come under the regulatory regime of the Department of Commerce. And I think that speaks volumes about the degree to which the industry feels we and they can work in very good unison together.

Mr. SMITH. Okay. Thank you, Mr. Secretary.

Administrator Bridenstine, NASA has had a long and strong relationship with the Department of Defense that you have mentioned, and should the Department of Commerce take over the space traffic management, is your relationship with DOD going to change one way or the other? And also, what would be NASA's role in dealing with the Department of Commerce on some of the issues that you have been dealing with the Department of Defense?

Mr. BRIDENSTINE. That is a wonderful question. So even right now, NASA has folks at the JSpOC that are looking out for the interest of NASA, with all the great data and tools that are available inside the JSpOC. So that is happening right now.

And if there is a NASA asset that could be at risk because of an object that is being tracked at the JSpOC, those orbital safety analysts ultimately take that data and they get in touch with one of two people. They go straight to Johnson, where they report it to the trajectory operations officer, we call it the TOPO, you know, at Johnson Space Center.

And then they do further analysis to determine if that object could ultimately put the International Space Station at risk. That is what they are specifically looking for. And then if it does, what do we do about it? So that is on one hand. And on the other hand, some of the data goes to CARA [Conjunction Assessment Risk Analysis], which is over at Goddard, for the robotic capabilities.

But I guess my point is to your question, the answer is yes, we have a great working relationship with the Department of Defense. We have our NASA personnel working side by side with their folks at the JSpOC feeding data to our centers to make sure that our assets are protected. And I anticipate that will continue.

As General Hyten has said, if we win we move to a day where Commerce is at the helm of space situational awareness and traffic management, it is absolutely true that the Department of Defense will continue to keep the catalog, because they need to for their own purposes.

So it is possible that NASA would continue to have our personnel maybe at the JSpOC. No decision has been made. Maybe we could take the data from the DOD and combine it with commercial data over at Commerce and international data over at Commerce and ultimately get a better integrated space picture at a different agency, not that that would necessarily happen, but it could. And if it did happen, then we would want our folks over at Commerce and we would probably keep them at DOD as well. But, again, this is way early and undetermined at this point.

Mr. SMITH. Okay. Thank you, Administrator Bridenstine.

And, General Hyten, let me ask my last question to you. And it has just been mentioned both by the administrator and by Congressman Bera a few minutes ago in regard to the catalog of space objects that users take advantage of to avoid collisions in space. If the Department of Commerce takes over that responsibility and others that are now assumed by the Department of Defense, do you see any diminution in the quality of product, any diminution in the quality of service if the Department of Commerce takes over some of those responsibilities?

General HYTEN. So, Mr. Chairman, I think that the line in the Space Policy Directive-3 that says the Department of Defense has to maintain the authority of the catalog, the reason that is there is because you can't have arguing catalogs. You can't have one in the Department of Commerce and one in the Department of Defense and then you end up arguing.

We actually used to have that inside the Department of Defense, because we had one that was done by the Navy, one that was done by the Air Force. And it is not healthy to be arguing over which

one is better. You have to take the best data, build that catalog. And that is why I said the authoritative catalog will always be in the Department of Defense. Then we will feed that data into the Department of Commerce.

And they can take other pieces to do the interface with other nations, with the commercial sector, possibly with NASA. I would envision what Congressman Bride—I did it—Administrator Bridenstine said. I would see it at the JSpOC at Vandenberg, soon to be the Coalition Space Operations Center. We will have international partners, NASA, Commerce there, and then we will feed information out of there into Commerce, into NASA. I think that is the healthy way. But, like Secretary Ross said, we are still in the early days of figuring this out.

Mr. SMITH. Still, that clarification that you just mentioned I think is very reassuring to us, and it portends a wonderful relationship between DOD and the Department of Commerce.

Thank you, Mr. Chairman. I yield back.

Mr. ROGERS. Thank you, Mr. Chairman.

The Chair now recognizes Ranking Member Johnson for any questions she may have.

Ms. JOHNSON. Thank you very much, Mr. Chairman, and good morning. Let me welcome our witnesses and thank you for your service.

General, the Obama administration had considered agency roles and responsibilities for the civil SSA data and information services and had reached an interagency agreement that FAA assume that role. I understand that FAA, in coordination with DOD, was planning to do a pilot program at FAA on civil SSA data and information services.

What would that pilot program have entailed, and what are your thoughts on a pilot program as part of the transition of SSA data sharing to the civil agency?

General HYTEN. So thank you for the question, because it is important that we kind of go back in history a little bit to look at that. Because I have been working in this world for over two decades. In 1998 I transitioned a mission, a weather mission out of the Air Force into the Department of Commerce.

For the last 10 years, really since the Iridium-Cosmos collision in 2009, I have been working very hard in the interagency to try to figure out where to put that mission, because it is not inherently a DOD mission.

And so in the last administration, we were working with Commerce and Transportation. The FAA was going to do a pilot program. That pilot program was going to basically look at what it would take for us to ship the catalog into that organization and for them what kind of analysis tools, what kind of pieces would they have in order to do that information.

As we have transitioned, this administration and the new SPD-3 that just came out says Commerce is going to take the lead on that, based on the burgeoning commercial sector. From the STRATCOM [Strategic Command] perspective, from the DOD perspective, bluntly, it doesn't matter to me. We need a civil agency that is doing that role. Commerce makes sense. Transportation makes sense. That is a political decision. I think that Secretary Ross has

made a good argument today of why Commerce is properly the situation to do that.

I will work with whatever element that our Nation decides is the right place to do it, and SPD-3 makes it clear that Commerce right now is the lead. So in the next few weeks, we will be working closely with Commerce. If that changes, I will work with whoever it takes.

Ms. JOHNSON. Thank you very much.

Any other comments from other panel members?

Mr. BRIDENSTINE. Can you repeat the question one more time?

Ms. JOHNSON. The question that I had posed is about the program, pilot program that had started with the FAA being the lead and if any information is transferable or—

Mr. BRIDENSTINE. So I think some of the arguments are that especially commercial industry would like a one-stop shop. And one of the challenges we have right now is that, from my perspective, it looks very difficult to find a one-stop shop, because you have got the FCC [Federal Communications Commission] that is responsible for spectrum. You have got NOAA that is responsible for remote sensing and imaging and that kind of regulation. You have got the FAA that is responsible for launch and reentry. And, of course, NASA is responsible for giving advice on, you know, protecting the space environment when it comes to orbital debris and even, you know, preventing harmful contamination of planets and things like that.

So there are a whole host of different agencies involved in space at different levels. So the question then becomes how you do create a one-stop shop, and it looks increasingly more and more difficult all the time.

So how do we minimize—this is the key I think, Ranking Member Johnson, that we all have to recognize. How do we create the maximum regulatory certainty with the minimal regulatory burden? And if we can consolidate these activities in one Federal agency or another, that minimizes the regulatory burden for the commercial operators especially.

So Secretary of Commerce has I think very clearly articulated that they believe they have the capability. The President's Space Policy Directive-3 says that they want Commerce to lead that activity. And I think that is a great idea. In fact, I voted on the American Space Commerce Free Enterprise Act and supported it in the subcommittee and the full committee when I was on the other side of the—other side of the aisle here. So I think the key is it needs to be done. I think Commerce is a good place to do it.

Ms. JOHNSON. Thank you.

Did you have any comment, Mr. Ross?

Secretary ROSS. Yes. Well, couple of things. Commerce already has many space industry-facing resources. By statute, we are obliged to foster growth in the space commerce industry through the Office of Space Commerce.

Second, we license satellite remote sensing activities through the Commercial Remote Sensing Regulatory Affairs Office.

Third, we manage Federal spectrum through the National Telecommunications and Information Administration.

Fourth, we manage space weather data collection and distribution through NOAA.

Fifth, we enforce the export administration regulations as they apply to space objects through the Bureau of Industry and Security.

Sixth, we promote U.S.-based industry abroad through the International Trade Administration.

And finally, once the payload is separated from the rocket, it is usually a different owner. The launch system is very different and it is usually a different entity from the one who has the payload. So there is no continuity between launch and what goes on once the payload is in outer space. That payload often is not, comes under our orbit in any event.

I hope that explains why we think we are quite logical.

Ms. JOHNSON. Yes, sir. What agencies now within Federal Government that currently carries out the research on SSA and the orbital debris, and to what extent are those activities coordinated?

Mr. BRIDENSTINE. Ranking Member Johnson, NASA, of course, does a lot of the research and technology. We really kind of set the standards that ultimately get followed by the other agencies. So NASA is very involved in it. We partner with universities and the commercial industry to come up with the best practices and the technology and research. And so, when it comes to the S&T [science and technology] piece of it, NASA really takes the lead.

General HYTEN. And Representative Johnson, we have a lot of capability in the Department of Defense to look at that, but I would agree with Administrator Bridenstine, that NASA is the lead when it comes to the S&T into that. We take most of the algorithms and incorporate into what we do. We have to be able to characterize that, which is why we still do research in that area, but NASA is clearly the lead.

Ms. JOHNSON. Thank you very much. Just one final question. How could this work be leveraged in a civil operational SSA system?

Mr. BRIDENSTINE. So ultimately, the idea behind SSA and STM, if we want to be as safe as possible, we need more data, and we need better data, more accurate data, and we need the ability to process that data. And so when it comes to science and technology, which is what NASA does, those are investments that we make. We want to be able to get more data, better data, and be able to process it in a way that ultimately gives us a much more safe environment, and then take that and hand it to the agencies that actually do SSA and STM.

Ms. JOHNSON. Thank you very much.

Thank you, Mr. Chairman.

Mr. ROGERS. I thank the gentlelady.

The Chair now recognizes the gentleman from Colorado, Mr. Lamborn, for 5 minutes.

Mr. LAMBORN. Thank you, Mr. Chairman, and thank you all the chairmen for putting together this great hearing. And thank you for the panelists for what you are doing for our country. And I have got one question for each one of you.

General Hyten, a lot of the data standards work for space situational awareness is done in Colorado Springs at Air Force Space

Command. So how will this policy affect that tremendously important work?

General HYTEN. So the work that we need in order to characterize threats will continue. It will continue through STRATCOM, through my Joint Force Space Component commander, who is also the Air Force Space Command commander in Colorado. He has the people that do that work. That work will continue. It has to continue. But I think what will change as we look into the future, and this is just a natural progression as we look in the domain, is that we will have to partner closer with, not only NASA, and the Department of Commerce, Department of Transportation, but the commercial sector as well, because there is a number of significant commercial entities that actually do this mission. And they have capabilities that we need to be able to leverage as well.

So it can't be that one size fits all. We have to take the best debris from wherever it comes and integrate that to provide the best capabilities we can.

The interesting thing that, you know, following on to what Administrator Bridenstine just said about the data, most of the data comes from the Air Force. Most of the data comes from the Department of Defense. We will ship that into multiple places, though, and people can use that data to produce better products. And I think that if we do it right, we will get benefit out of that and the Department of Defense because the folks that do that business will learn from others doing it as well and we will apply the best practices in the business that we have to do in the military.

Mr. LAMBORN. Okay. Thank you. And oh, I see that the clock is working now. So I guess I better hurry.

Administrator Bridenstine, and we have touched on this already with other questions previously, but do you believe that utilization of best of breed commercial SSA processing software for enhanced foundational SSA for NASA to avoid a potential catastrophic debris collision with the International Space Station is the best way to go? Or where should that software come from?

Mr. BRIDENSTINE. That is a great question. The answer is to the extent—and, of course, this is in the future, we are not there yet—but to the extent we have a regime to do space situational awareness and space traffic management that is outside the Department of Defense, and instead in a civil entity, there are different ways it could be organized.

And, of course, one of the ways it could be organized is that it could be done by commercial providers of space situational awareness that, in fact, some of which exist right now today. The Space Data Association, for example, the ComSpOC [Commercial Space Operations Center], and there are other companies providing data that feed the ComSpOC and the Space Data Association. So these are all technologies and capabilities that can be done commercially, can be done privately.

The question is, going back to what General Hyten was talking about earlier, is who controls, who manages the data set, the catalog that is definitive. And ultimately, can it be enhanced with commercial, and those kind of things?

One model, as I said earlier, is you could have multiple commercial companies and/or non-profits or universities competing to pro-

vide SSA and STM to space operators. And the reason you want competition is because it drives down price, it increases innovation. Again, you get better data and more data. That is a model that works. And then ultimately, the people that pay for the data, that pay for the subscription would be the operators.

It is also true that we have to balance this with the idea that we don't want to drive people to other countries for their space situational awareness and space traffic management by having people in the United States pay for a subscription or pay for fees. So this is a balancing act.

We want the United States of America to be preeminent when it comes to SSA/STM; and at the same time, we want to have commercial capabilities that give us more data, better data, and a competitive environment to drive down cost and increase innovation.

So it is very early in the process. It is something that we really need to think through, and I am happy to be a part of it.

Mr. LAMBORN. Okay, thank you.

And I was going to ask you, Secretary Ross, the same question. In just a few remaining seconds, do you want to address that? And then I will yield back the balance of my time.

Secretary ROSS. Well, I agree very much with what the administrator has just said. There are alternate models that could be used, but at the end of the day, somebody in government needs either to do it, or to license the private sector to do it. So either model in concept could work, but you still need a government interface. I don't think it is an activity that should just be left unbridled to the private sector. And I think everybody up here will agree with that.

Mr. BRIDENSTINE. I agree with that, Mr. Secretary.

Mr. LAMBORN. Okay. Thank you. I yield back.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes the gentleman from New Jersey, Mr. Norcross, for 5 minutes.

Mr. NORCROSS. Thank you, Chairmans, for coming together to have this discussion.

And it is good to see a member of HASC as the administrator of NASA, certainly. The questions that I want to follow up on are ones that we have all been working around.

When we talk about the assets, the assets of collection, whether ground-based or space-based, who ultimately will be the decider of those assets? Who is going to purchase them? Who is going to look into them? And when that decision is made, I would assume most of these things are going to have to go through the Department of Defense first to say what is sensitive nature and who decides, who makes that decision, whether or not this information gets released to the commercial side.

So, A, the assets, who is going to make the ultimate investments, and I have heard you talk about the commercial side, but ultimately—we don't want duplication, but it all goes through the filter of the Department of Defense. So ultimately, who makes that decision on what information gets derived to the commercial side and who pays for the assets? If we could start with General Hyten.

General HYTEN. I will start, Congressman.

So I believe that if you look at it as a building block of capabilities, I think the baseline capabilities is in the Department of De-

fense, and the Department of Defense will have to pay for that baseline. That baseline is what we need in order to understand what our adversaries are doing in space—

Mr. NORCROSS. That is the highest and number one priority.

General HYTEN. That is the number one priority. So the bill for that comes to the Department of Defense. We have to pay for the sensors. We have to pay for the ground sensors, the space sensors, and the processing that allows us to do that. Now, that is the baseline. But it doesn't talk about the interface with the commercial sector. It doesn't talk about the interface with others. We have been making that up. I mean, literally making it up for 9 years now. We need to have a structured process. And that is where the commercial sector can come in. That is where the Department of Commerce can come in. And they can look at a different way of doing business.

They can bring in other sources of information, other display tools, other capabilities that can do that. They may decide that there are other sources from the international community that they can bring in. I would hope that we have a partnership where if they bring other sources, they will feed that into our algorithm so we can take advantage of that too. We will have to work through those issues, but I see there is a baseline building block that the Department of Defense is responsible for, and then NASA, Commerce, the commercial sector, can build on top of that for other applications and other needs.

Mr. NORCROSS. But would you ultimately have veto power if there is a piece of information that is coming from the Commerce side over to you that you see.

Mr. ROGERS. Ms. Norcross, is your microphone on?

Mr. NORCROSS. Hello.

Mr. ROGERS. There we go.

Mr. NORCROSS. I usually can be heard. Do you ultimately have veto power on what information gets released?

General HYTEN. So I think veto power is maybe too strong a statement. We are not going to have veto power. But this is the way it would work from a Department of Defense perspective, the algorithm that we use that processes all of this information that comes in, it is exquisite information, and we are going to take commercial, international, we are going to take all the information that we get. But believe it or not, some of it is better than others. Some data is better than other data. And the algorithms will be able to tell. And so if the data that we get from whatever source is deemed not as good and not providing the most accurate answer, we won't use that data in our solution set. That is why it comes back to the authoritative catalog is the key.

The authoritative catalog will take all the best data information. But at this point in time, from my perspective, all data is good, and then we will mathematically decide what is the best data.

Mr. NORCROSS. And then on the commercial side is where you would make those decisions?

Mr. BRIDENSTINE. So there could be capabilities where somebody who has, maybe a commercial radar, or a commercial telescope that is creating their own data, that they could actually get data that the Commerce Department might not have. Or they could get data

that even the DOD might not have. And then they could share that data with either or both.

So we don't want to limit the idea that only the government can do it. We need to have partners that can share. One of the challenges sometimes, is that when you think about international data, they might not want to give it to Strategic Command. They might be willing to share data with Commerce. So that is a reason, another reason we need a civil authority doing this rather than simply the Department of Defense.

It is a lot like NASA, as a matter of fact. A lot of countries around the world don't want to partner with the United States Air Force, but they love to partner with NASA, because we are a separate space agency capable of doing science and technology apart from any kind of military capability, so—

Mr. NORCROSS. This is where you would allow the private sector who was doing this also in through those doors?

Mr. BRIDENSTINE. Absolutely. And a lot of that private sector might be more than happy to share the data with the Department of Defense or others, and, in fact, they already do, in many cases.

General HYTEN. That is why I say I hope they would share, but I can't guarantee that.

Mr. NORCROSS. I yield back.

Mr. ROGERS. I thank the gentleman. The Chair now recognizes the gentleman from California, Mr. Rohrabacher, for 5 minutes.

Mr. ROHRABACHER. Thank you very much. And this is very gratifying. We have an administration that is clearly committed to focus on space and what we can utilize space for and what the dangers are and what the potential profit and benefit is. And especially when we have a Secretary of Commerce personally engaged, this has got to give a whole new energy to America's space efforts. And I am very proud of each and every one of you and proud of our President for also stepping forward in this way.

I believe that we have reached a tipping point in space beside what I just described. And that is, we have now reached a time in space where we have capabilities of doing so much more than what we are doing today. And the private sector has the possibility of doing so much more because of our technological capabilities. But at the same time, we have reaching a tipping point where space debris may get in the way of us achieving that goal.

So this is the first step that I have seen that we are taking space debris seriously and that will open the door for some of these other great potentials that we have.

We have whole constellations in the private sector being proposed for remote sensing and observation that could be very profitable businesses, but we know that unless we come to grips with this space debris challenge, they will not be going up.

Let me ask you this: And I appreciate the fact that we are now talking mainly about cataloging and bringing in even the private sector for helping us catalog the problem. And make sure we know what the problem and defining what it is. But have we given any thought to actually having the private sector, once it is cataloged, doing something about it, meaning, actually having the private sector help us in extracting and taking some of this space debris, bringing it down? I would just like to ask that to the panel.

Mr. BRIDENSTINE. Congressman, the answer is absolutely yes. Of course, NASA is very involved in making investments right now to do robotic servicing of satellites in orbit, which would be an absolute game changer. And when you think about the constellations that are going into low Earth orbit for communications, we are talking about thousands and thousands of satellites, what we don't want is each one of those satellites, when they become defunct, we don't want them just becoming a piece of space junk, right? We need to be able to either, A, service them, or, B, de-orbit them. And I think there are good plans underway for that.

But to the extent that NASA is making these investments in robotics, it is not just for servicing, it could ultimately be for, you know, the kind of activity you are talking about, which would be remediation, you know, getting objects out of space. But that has to become, as you mentioned, you want it done commercially. I think that would be beneficial to everybody. The way it becomes available commercially is ultimately to do robotics for servicing of satellites, have half a dozen, maybe even a dozen different companies, each with their own constellations of a dozen or more satellites doing robotic servicing.

Once they are in orbit doing this activity commercially, because, again, they are doing it to serve customers that are providing, you know, DIRECTV, Dish Network, internet broadband from space, they are doing it for those purposes, well, then, while they are there, they can also do some remediation and the United States Government can actually pay for that service.

So this is an architecture that needs to be developed. NASA is making investments, like I said, in the robotics. We are making investments in rendezvous and proximity operations autonomy, propulsion capabilities that can have a specific impulse that can keep us, our satellites active for a very long period of time.

So navigation, of course, the sensing that is necessary to do ultimately the approaches and rendezvous and proximity. So we are absolutely right now making investments in that activity. When it is going to be sufficiently mature to move out on what I think you are hoping that we can do, I don't have answer for that at this time, but certainly—

Mr. ROHRABACHER. All of you are laying the foundation towards the next step. And without taking care of this challenge, we will impede all the other great things that humankind is capable of.

So thank you all. And Secretary Ross, especially thank you. The general is out protecting our country in so many ways, and this is part of it. And Secretary Ross, you are the guy who is going to oversee commerce in the United States, and, you know, this industry, the aerospace industry is a tremendous asset to our country, and we are relying on you to, as you are showing today, take leadership and keeping that a major part of our economy.

Secretary ROSS. Thank you, sir.

Mr. ROHRABACHER. All right. God bless.

Mr. ROGERS. The gentleman yield back?

Mr. ROHRABACHER. Yeah. My time was up anyway.

Mr. ROGERS. The Chair now recognizes Mr. Perlmutter for 5 minutes.

Mr. PERLMUTTER. Thank you, Mr. Chairman. And, gentlemen, thank you for your testimony today.

I just want to sort of get back to some basics just so I understand the terminology here, because we are talking about space situational awareness, which seems kind of wonky, and traffic management.

So General, from your testimony, I understand you, the Air Force, Department of Defense, would be, in effect, in charge of the space situational awareness with your monitoring capacity. Is that right?

General HYTEN. Space situational awareness is a mission for the Department of Defense, and we will continue to do that mission. But it is interesting when you relate it to space traffic management, because the reason we started doing the space situational awareness mission, it was one of the—it was the foundation of the space control mission when I started this business 30-something years ago. We did it for space control. But when we started attaching space traffic management to it, we started thinking the catalog was actually to enable space traffic management.

That is not why we do SSA. We do SSA to help defend ourselves against threats. And by having somebody else responsible for the space traffic management picture, the Department of Commerce in this case, will allow us to get back to using our SSA mission to focus on our space control mission, which is the essential piece, and somebody else will be doing the space traffic management. It is not that we don't have a role to play. We do. But that is not our focus.

Mr. PERLMUTTER. But your main role is to just catalog and gather all of this information, which, then, you will share with NASA and with the Department of Commerce and other important agencies—

General HYTEN. Yes, sir.

Mr. PERLMUTTER [continuing]. Intelligence agencies, whatever they may be.

General HYTEN. Exactly.

Mr. PERLMUTTER. So Mr. Secretary, let me turn my questioning to you. So under this approach that has come out of the Space Council and from the administration, Commerce is in charge of traffic management. And so, that is a concept that is not so hard for me to understand, because I just think about, okay, who is the law enforcement? You know, who gives the tickets? You know, who tows the abandoned vehicle? Who plows the road? You know, how do these kinds of things occur. And some of it is going to be commercial and some of it will be regulatory. I mean, is that how you look at this?

Secretary ROSS. Yes, I do. And as you are probably aware, we already have very extensive collaboration and cooperation with Department of Defense in our export control activities, because those interface both with national defense and with our job as being the ones to find people who are violating sanctions on countries, who are planning to export militarily sensitive materials.

So we have a pretty well-established vocabulary of how to deal, between the Department of Defense and ourselves, and this will just be another addition to that.

And I agree with what the general said. One size doesn't fit all. There are going to have to be adjustments as we go along. And the technologies will evolve, new space ventures will evolve. You are going to get into lunar habitation, you may very well get into asteroid mining, all kinds of activities—

Mr. PERLMUTTER. So I am comfortable with—I mean, somebody in this hierarchy has got to take the lead on if there is a collision, you know, whose insurance pays for it.

Secretary ROSS. Right.

Mr. PERLMUTTER. You know, that kind of thing. And Mr. Administrator, you and I have had this conversation several times. What are your thoughts, just the basics of this?

Mr. BRIDENSTINE. A few things. As a pilot, if somebody says to you on the radio, "Call sign turn right 030 descend, maintain 10,000 feet," you do it. Why? Because if you don't, it is illegal and you could possibly die. So that is why you do it.

Right now in space, nobody has authority to compel you to maneuver. They can tell you, either the Department of Defense, the Strategic Command, can tell you it is a good idea, but they can't tell you to do it. So that is the difference between space situational awareness, and, ultimately, space traffic management.

One of the challenges with space traffic management is if you compel somebody to maneuver, you could be burning 4 months of their station-keeping fuel just to prevent them from having a collision. And the best we can do these days, in some cases—not all cases, but in some cases—the best we could do is, you know, there is 1 in 10,000 chances that your satellite will collide with another satellite.

And are you going to burn 4 months' worth of station-keeping fuel and give up 4 months' worth of potential revenue as a company in order to avoid a 1-in-10,000 chance? Now, the answer is you are probably not, but when you think about the catastrophic consequences of not maneuvering, should that 1-in-10,000 chance occur, you can deny access to space or at least make it more problematic for, you know, generations to come.

So this is a big deal. There has to be some agency that is capable of doing that. Again, I want to be clear, because this makes a lot of space operators nervous, we want an absolute minimal regulatory burden with maximum regulatory certainty and safety.

Mr. PERLMUTTER. But there has to be some kind of management. And I agree with that, and I yield back to the Chair.

Mr. ROGERS. I thank the gentleman. The Chair now recognizes Mr. Brooks for 5 minutes.

Mr. BROOKS. Thank you, Mr. Chairman. Forgive me for diverging from the primary focus of this hearing, but it occurs to me that each of you has significant persuasive influence on where the new Space Command will be headquartered, so I am going touch on that for just a moment.

In that vein, I hope you will help make Redstone Arsenal a finalist in the Space Command headquarters debate. Redstone Arsenal has a lot to offer. We have, related to Space Command, either related a lot or related a little, the following Space Command activities: United States Army Aviation and Missile Command; Aviation and Missile Research, Development, and Engineering Center; PEO

[Program Executive Office] Missiles and Space; United States Army Space and Missile Command; Army Forces Strategic Command; United States Missile Defense Agency; Defense Intelligence Agency Missile and Space Intelligence Center; NASA's Marshall Space Flight Center, which is the home and birthplace of America's space program; a wealth of intellectual talent, engineers—we have the highest concentration of engineers in the United States of America—physicists, mathematicians, scientists.

In conclusion, I hope you will concur that Redstone Arsenal and the Space Command seem like an excellent fit.

Now, with that sales pitch behind me, let's go more to the substance of this particular hearing. I do appreciate your indulgence, and I know you-all all have persuasive influence on the ultimate outcome of that Space Command location debate.

I know that the Department of Defense has done some interim work with the Federal Aviation Administration on SSA. With respect to Jim Bridenstine's Space Renaissance Act from last Congress, to put the one-stop shop for commercial space at the Department of Transportation, not the Department of Commerce, what would be your insight, your perspective on where we are looking at now?

Mr. BRIDENSTINE. A great question. As you just recognized, I have, in the past, sponsored legislation, authored legislation to have the one-stop shop be at FAA AST [Office of Commercial Space Transportation], especially taking AST and moving it out of the FAA and making it a direct report to the Department of Transportation, specifically to the Secretary.

So that was legislation that I ran a couple of years ago to really force the conversation about this kind of activity and how important it is.

Now, I would also tell you as a member of the Science Committee, Space Subcommittee specifically, I have voted multiple times on the American Space Commerce Free Enterprise Act, which puts this at Commerce.

So my views on this, of course, have shifted, but I think more importantly than anything else, it has to be done. And to me, it doesn't matter so much where, just the fact that we don't have time to waste anymore. And if we get caught in whether it is a parochial issue or a jurisdictional issue among committees, and this thing gets held up for a year or two, we are at risk, especially when you consider the large constellations that are going to be put into low Earth orbit.

I think Secretary Ross has made a compelling argument for why it should be Commerce. I fully support that, and I am ready to move out on it.

Mr. BROOKS. General Hyten, question for you, but first a comment.

It is always good to see someone with the success that you have enjoyed from my hometown, Huntsville, Alabama. So any time you get a chance to come back, we have got over 100 generals who have retired there. I am sure you would be welcome, too, when that time comes.

General HYTEN. Are you trying to retire me, Congressman?

Mr. BROOKS. This question is for you. What is your assessment today of the Department of Commerce's ability to manage these authorities, and do they have the proper resources and personnel needed to manage these authorities? And if not, what is your opinion on what is needed to get them there?

General HYTEN. So, I guess if it is a yes-or-no question which you just asked, then the answer is no, they don't have all the things they need to do.

But Secretary Ross realizes that, and he has committed inside the National Space Council, he has committed to me at breakfast this morning, that he is going to identify the right people if he has to go down this path and put those people at this job.

His folks have been unbelievably transparent and helpful in defining what this space traffic management piece would be in the Department of Commerce. They have been straightforward.

So he does not have all the issues he will need to do that job in the future, but he has committed to making sure he identifies those and pursues those. I am sure he will be working with you on that issue in the future.

Mr. BROOKS. Well, with respect to Secretary Ross and General Hyten, and, of course, Jim Bridenstine, I happen to serve on the—I am vice chair of the Space Subcommittee of SST [Science, Space, and Technology Committee], and I am also on the Strategic Forces Committee of House Armed Services Committee.

So if there is anything I can do to help ensure that the Department of Commerce has the resources it needs, please let me know in wearing one hat or the other.

Mr. Chairman, I yield back the remainder of my time.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes Mr. Lamb for 5 minutes.

Mr. LAMB. Thank you, Mr. Chairman.

Mr. Bridenstine, first question for you.

You mentioned a couple times that you thought that if we took the lead on SSA in the United States and developed a better system through the Department of Commerce and worked with private enterprise, that that would actually give the United States a competitive advantage when it came to firms actually opening their businesses and putting their capital here in the future.

Would you mind elaborating on exactly how that would work? Because I am just sort of picturing if what we are doing is really making data available, why would that actually give firms an incentive to locate in the United States? Or how could we make sure that it does, I guess?

Mr. BRIDENSTINE. Great question. So the idea is that we have companies that are international, investing, in many cases, billions of dollars into constellations that will be in low Earth orbit. And those companies are going to be looking for opportunities to protect their investments. How safe of a regime are they going to have, and certainly, they are going to want access to, you know, what the United States has to offer.

Now, it is absolutely true that given the current regime that exists right now, the Department of Defense, through STRATCOM, ultimately provides space situational awareness and conjunction

analysis to the entire world, and they do it for free. And they do it for free because we have to protect the space domain.

I mean, if you look historically, the Department of Defense got into this business because they were trying to protect American national security interest. Well, it is still in America's national security interest to prevent collisions and more orbital debris in space.

But I do believe that if the United States of America has a regime that could be commercial, and it could be led by a civilian agency, that a lot of companies all over the world are going to want to establish American companies to get the absolute best data for the protection of their \$1 billion investments, or \$100 million investments, big investments.

And that, I think, is good for America. It grows the economy, it helps our balance of payments and our trade deficit, and I think that that is a big piece of what we ought to be doing. It also could lower insurance premiums if they have access to that data.

Mr. LAMB. Does that place the onus on us, then, to make sure that any data-sharing from the civilian agency with private firms would be dependent on that private firm having an American presence, essentially?

Mr. BRIDENSTINE. So there is different levels. We talked about having basic SSA data that would be necessary for safety, in general. And then there is data that could be made available from commercial operators that would provide an enhanced level of protection, if you will. And so finding that right balance, I think, is important, because we want to have a competitive market where we are trying to get more data and better data.

But as everybody here has agreed, it is inherently governmental, because ultimately, it is in everybody's interest to protect space. So we have to have that civil agency that is responsible for it ultimately.

Mr. LAMB. Thank you. General Hyten, I just wanted to follow up on a point in your testimony about our adversaries, other countries, even some of our allies making increasing investments in space at the same time. Can you talk about any of those to the extent you are able here that should concern us or that make the space more competitive than we might realize, investments being made by other countries?

General HYTEN. So both China and Russia have invested enormous amounts of their national treasure to build capabilities for the sole purpose of countering the United States advantage in space. They built ground-based capabilities, space-based capabilities, a variety of different technologies that I can't go into in this hearing. But enormous amounts of their treasure with the sole purpose, it is not for something going on in the Western Pacific, it is nothing for going on—the sole purpose is to counter the United States advantages in space.

And as the commander responsible for defending the Nation in that domain, I have to look at those capabilities as real threats. And that means I have to develop counters to those threats, which is why the first thing I have to have, just like in any other domain, is exquisite situational awareness of what is happening in that domain so I can respond quickly enough. That is the same in air, land, sea. It is the same in space.

Mr. LAMB. Are they spending more than us in any of these domains, General, or just more than they have in the past?

General HYTEN. I can't go into specifics, but in certain areas they are investing more than we are. Our capabilities are so huge, enormous, powerful that the capabilities they have really can't impact us today. But what we have to make sure is that 10 years from now, 20 years from now that is still the same. That is the challenge.

Mr. LAMB. Thank you very much.

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

Mr. ROGERS. I thank the gentleman.

At this point, we are going to pause for a minute. While we very much appreciate Secretary Ross and his participation in this hearing has been very helpful, he has been called to the White House. So we are going to excuse the Secretary and take any further questions for him for the record, and allow him 10 days to provide a written response to the member who has a question. And with that, thank you, Mr. Ross, and you are excused.

Secretary ROSS. Thank you, Mr. Chairman.

Mr. ROGERS. The Chair recognizes the gentleman from Louisiana, Mr. Higgins, for 5 minutes.

Mr. HIGGINS. Thank you, Mr. Chairman.

Gentlemen, thank you for your service to your country. Administrator Bridenstine, you display a tremendous amount of common sense, which makes it very clear why you are no longer in Congress.

You gentlemen have provided excellent testimony in a very fascinating time in our history of mankind where space has clearly become a theater of engagement militarily, while at the same time is a new frontier for tremendous expansion of commercial activity.

We have models like this, of course, throughout the history of man, there has never been a theater of engagement that did not include civilian commercial activity, be it by land, sea, or air. So the models of the past, as they help us to plan for the future, I believe we are on the right track here, because the DOD needs to handle defense and warfare capabilities in any theater of engagement. And to divest itself—and it is understandable why over the last, you know, several decades, DOD has become deeply involved, it is obvious that cataloging the activities in space, because of the responsibility of recognizing space as a theater of engagement, it is understandable why this has happened and got to this point, where DOD is doing a tremendous amount of activity that pulls it away from warfare capabilities. And it makes sense that at this juncture we would divest some of those responsibilities to the appropriate agency.

So with respect to my colleagues on both sides of the aisle, I believe what we endeavor to determine with absolute certainty is which civilian agency is appropriate to relieve that burden from DOD. So it has been suggested, and I am leaning yes to concur, that the Department of Commerce is that agency.

So General, is this a good idea? Is this a win for America and for the defense of our Nation?

General HYTEN. So, Congressman, this is actually a great day. Probably should have said that earlier on. Because this is a day

that we have been looking for for a long time. We have had interesting dynamics. The first time you see a collision between a piece of debris and a Chinese satellite, what are you supposed to do?

Well, I remember that conversation, and the commander saying, tell them. You know, we don't want a collision to happen. But how is that a Department of Defense mission? And so we started a long time ago trying to figure out how do we do this differently? That shouldn't be the responsibility of the Department of Defense. We shouldn't be forcing our airmen, soldiers, Marines, to make those kinds of decisions. That is clearly other elements of our government.

So we have gone back and forth where it needs to be. The administration has decided Commerce is the place. Secretary Ross has jumped in and said, I am the guy, let's go ahead and do that. I am all in with that. I am all in. I think that is the right decision. We just ought to go.

Administrator Bridenstine said the same thing a while ago. We got to just go now. It is the time. We can't waste any more time.

Mr. HIGGINS. I concur. Administrator, would you comment on that question, please?

Mr. BRIDENSTINE. Here is what I would like to share. I think it is an important philosophical debate, but when you look at the expansion of humanity, whether humanity is crossing the Atlantic or crossing the continents from, you know, from east to west, or expanding into space, if you will, it is all driven by commerce.

And philosophically, if we are going to go further, it is going to be driven by commerce. And the resources that are available in space are quite frankly, they are limitless. And so Commerce, I think should take the helm here for that basic philosophical reason.

The other thing that is important to note is that space has transformed all of our lives, and we are now dependent on space in ways we never—a lot of Americans don't recognize how dependent we are on space. The way we navigate, the way we communicate, the way we produce food, the way we produce energy, how we do disaster relief, predict weather, monitor the climate, the way we do national security and defense. All of it depends on space.

In fact, the GPS signal is required for banking. If we lose the GPS signal, that changes. In fact, it could be catastrophic for our country. If you lose the GPS signal, you can't do banking, next thing you know there is no milk in the grocery store. Civil unrest. That is a huge challenge.

So here is the important thing, going back in time when you think about the history of naval power, for example, Alfred Thayer Mahan, he was a great theorist on naval power, commerce ultimately results in that commerce being threatened.

And that is what is happening right now. Our entire way of life is dependent on space. And our, not enemies necessarily, but our competitors know that, and they are developing capabilities to thwart our way of life.

And so if commerce is important for the power of nations as Alfred Thayer Mahan said back in the 1800s, then defending that commerce is also important as well, or protecting that commerce, which is, again, why I believe it is perfectly legitimate and good

that Commerce take the helm of providing space situational awareness and space traffic management.

Mr. HIGGINS. Gentleman, you present a compelling argument. Mr. Chairman, my time has expired. I yield back.

Mr. ROGERS. I thank the gentleman. The Chair now recognizes the gentleman from Oklahoma, Mr. Lucas, for 5 minutes.

Mr. LUCAS. Thank you, Mr. Chairman. And in response to your invitation, I have a question for Secretary Ross that I will submit basically noting my curiosity about as we transition to this new plan, since I don't see anything in the fiscal year 2018 and 2019 budgets to help the Department of Commerce finance that, how they plan on addressing it. But I will submit that in writing.

If I could turn now to my fellow Oklahoman, the administrator, Mr. Bridenstine. First of all, I promised your constituents I will provide the most intense oversight—

Mr. BRIDENSTINE. Oh my goodness.

Mr. LUCAS [continuing]. Of your life for the rest of your career in that role, which would be an awesome experience. Just taking care of my fellow Oklahomans' concerns.

Let's talk for a moment, though, in general, if you would, since this summer is the 60th anniversary of the legislation that created your agency when the Eisenhower administration and our predecessors in Congress determined that we needed to have a civilian perspective on space exploration.

As we talk today about what Commerce is going to do and the continued important mission of the Department of Defense, where do you envision NASA actually playing as these issues evolve over the coming decades?

Mr. BRIDENSTINE. So NASA is an agency, we do discovery and exploration. We do science. And, of course, we are not involved in national security space. We are not involved in defense. But certainly, we want to make sure that our assets are secure. And that is when you think about space situational awareness, space traffic management. And the fact that we have humans in orbit right now, we have to be very aware of the space environment and the risk that it poses to our astronauts.

So I like how you framed it, Chairman Lucas, that in 1958, Eisenhower created NASA. He did it with an expressed intent that space exploration not be part of the Department of Defense. He wanted it intentionally separate. He wanted a peaceful agency that can partner with the rest of the world in making civilization-changing discoveries. That was his objective.

And what I would say now is we don't necessarily want space situational awareness and space traffic management to be a Department of Defense specific issue. Certainly, they are going to do that, but they don't have to do the conjunction analysis and warning for the entire world for free, and not to mention all of the commercial operators as well.

So I think it is important to have a civil agency capable of doing that, just like Eisenhower envisioned for NASA back in 1958.

Mr. LUCAS. General, some 30-plus years ago, I had a conversation at a public event with a colonel who was an officer in, I believe, what is probably your organization now 30 years back. And as a nonpublic official, I spent a little bit of time asking him a vari-

ety of questions, being inquisitive. And he was one of the most cautious, methodical, thorough officers I have seen. He said absolutely nothing.

But I finally asked him a question, and I will ask you a question, the same question I asked him. How do you sleep at night? Thirty-some years ago he said, I sleep very well at night. How do you sleep at night with your responsibilities?

General HYTEN. I sleep very well.

Mr. LUCAS. Thank you for the answer I wanted.

I yield back, Mr. Chairman.

General HYTEN. One comment on that. It is important. The reason I sleep well, as I mentioned in my opening statement, because I have 162,000 of the best and brightest that America has to offer that do the job every day. And they actually do the work. I don't do any of the work. They do the work.

And because they are out there deployed under the ground, under the sea, in the air, operating in space, that should allow you to sleep well, because it allows me to sleep well.

Mr. LUCAS. And that is the exact point I wanted you to make, General, because the general public does not have an understanding or an appreciation for all of that. And for 30-plus years this important role has been fulfilled.

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

Mr. ROGERS. I thank the gentleman. The Chair now recognizes the gentleman from Georgia, Mr. Hice, for 5 minutes.

Mr. HICE. Thank you, Mr. Chairman. And I will just say to the administrator, welcome back. We are honored that you are in the role you are in. We will miss you here, but you are the right person for this position at this time, and we are honored deeply that you are in that role. And welcome back here today.

Mr. BRIDENSTINE. Thank you.

Mr. HICE. General, let me begin with you. Just in light of all the conversation today, how do you prioritize the competing interests and needs between DOD, commercial, and SSA requirements?

General HYTEN. So it goes back to the discussion of a building block. So the building block, the essential building block, from my perspective, is our national security. And so that is the first thing that I have to worry about. Do we have enough information, enough situational awareness to allow me to exercise the authorities and responsibilities that have been given to me for the mission of Strategic Command and defend our Nation in space.

That is the first priority. That is the priority that the United States Department of Defense has to pay for, has to understand, et cetera. We have chosen over the last 9 years, since the Iridium-Cosmos collision, to pay for kind of the rest of the world, both with resources in manpower and money to provide that kind of collision warning, situational awareness for the world because we realized after the Iridium-Cosmos collision in 2009, if a collision occurs it is really bad for the security of America and for the security of the world.

So nobody was doing it, so we said we can do it, so we did. But ever since that time, we have been looking for the structure that will allow us to just focus on our national security mission and have somebody else do that. Somebody else also pay the resources

for that additional function. Not above the baseline. We still have to continue to do the baseline, but all those other pieces from that.

Now, the Space Policy Directive-3 designates the Department of Commerce is the person to step up and do that, and Secretary Ross has said he is the guy, he is going to step up and do that. And that is what we, in the Department of Defense, have been looking for, for a number of years. So we are happy with where we are right now.

Mr. HICE. So are you saying the Department of Defense will be the top priority followed by SSA, then commercial? Is that kind of—

General HYTEN. Well, from an SSA perspective, not from a space traffic management perspective.

Mr. HICE. Okay.

General HYTEN. Space traffic management should be somebody else's job, but we have to focus on what we need from space situational awareness in order to allow us to defend ourselves in space, and defend ourselves against any adversaries that might challenge us in space. That means exquisite situational awareness. It just so happens that that information is what is also needed for space traffic management.

But we will give that data to somebody else to process, to do the analysis, to reach out, to reach out to nations, to reach out to companies. We have been doing that, and we have been making it up. And I am pretty proud of the folks that have been making that up, because it is a miracle to me that we haven't had a collision, but that should be somebody else's job.

Mr. HICE. Then in light of that, how much currently, how much manpower and resources and so forth do you use when dedicating efforts to negotiate SSA agreements with commercial foreign states and so forth?

General HYTEN. So for negotiating SSA agreements, it has been very small.

Mr. HICE. Okay.

General HYTEN. It is four or five people on my staff that do that work, and that is not their only job. They have other jobs that they do as well. But that is one of their additional duties, is to focus on that.

Mr. HICE. Okay.

General HYTEN. But the biggest impact, though, is the people that have to actually do the work, the processing. That number is in the dozens. That is what will be offloaded to significant numbers that will free them up to do what I believe is the real warfighting missions.

Mr. HICE. Okay. So in freeing that up, you will be able to better utilize it for defense purposes?

General HYTEN. Exactly.

Mr. HICE. Mr. Administrator, I heard you bring up earlier, and let me just ask you this, how will the trend that is currently underway for small satellites affect SSA capabilities and beyond?

Mr. BRIDENSTINE. That is another great question. So every orbital regime is different. Of course, we have a lot of assets in low Earth orbit. We have a lot of assets in geostationary orbit. Those are two orbits that are critically important and they will require

a space situational awareness and space traffic management regime that is very different than a medium Earth orbit or an orbit that is below low Earth orbit.

You know, sometimes I have heard people make the argument that CubeSats ought to be below the International Space Station in order to not necessarily be regulated at all with STM or SSA. That if you are below the ISS, you are going to be de-orbiting just based on the trace atmosphere at that level within 5 to 10 years anyway, so we don't really need a regime.

So what I would say is it is not necessarily the size of the satellite that matters, but what matters is where that satellite is positioned and the different orbital regimes are going to have different kind of requirements for, you know, where they are located.

Mr. HICE. Okay. Again, thank you both, gentlemen, for all you do. We are honored.

I yield back.

Mr. ROGERS. The gentleman yields back. The Chair now recognizes Mr. Mitchell for 5 minutes.

Mr. MITCHELL. Thank you, Mr. Chair. First, Mr. Bridenstine, I want to congratulate you on becoming the administrator. And thank you, as your departing the committee gave me the opportunity to join the committee. So congratulations. And I am warming your chair, I guess.

Mr. BRIDENSTINE. You are, indeed. Thank you for doing that.

Mr. MITCHELL. It is an honor, sir.

Question, if you could relay to also Mr. Ross, who will submit to the committee.

You had advocated as well that this, this situational awareness or traffic management go to the FAA. And the FAA is currently involved in that they certify launches, aircraft that are launched, they provide certification for that in this process.

Can you share with me how much involvement the FAA has been in this process as this transition is going on, and I will ask the same question of Secretary Ross as well.

Mr. BRIDENSTINE. Sure. So I will be honest. I have been in Congress until about 7 or 8 weeks ago, so I wasn't part of all the negotiations that got to the point where we were ready to announce SPD-3, so I do know that FAA was involved. There were meetings in the National Space Council where this discussion was had.

How robust it was and who said what and when, I am not 100 percent sure. But I can tell you that everybody is in agreement that I have talked to that this has to be done in a civil agency.

Mr. MITCHELL. Agreed.

Mr. BRIDENSTINE. And, you know, Commerce is a good place to do it. It is also important to note, as Secretary Ross noted, that Commerce is involved in space in a robust way already. A lot of people don't realize the National Oceanic and Atmospheric Administration, about 40 percent of their budget is space-related activities. And, of course, that is controlled by Commerce. And ultimately, they make purchases for those activities, and NASA is involved in buying a lot of their satellites, or at least doing a lot of the requirements generation and then the activities that are necessary to acquire those satellites.

So NASA is involved in that. But it is a Commerce function. It is also important to note that Commerce is involved in remote sensing licensing, and that kind of activity. So there is a lot of activities that are done both in Commerce and the FAA.

A couple of years ago when I drafted that bill, you know, my thought was, we will put it at FAA and we will take everything and put it at FAA. It appears now that the right course of action given the consensus that has been come to is that it be at Commerce. And I fully support that. The key is, it needs to be done. That needs to happen.

Mr. MITCHELL. I agree that does need to be done.

One of the questions I have, as you well know, is space and commercial FAA-type traffic isn't a clean division. There is clearly, and I have talked with several folks involved, SpaceX and others. There is an overlap of that. How do you reconcile and maybe, General, you have some feedback, how do you reconcile that or make it work?

Mr. BRIDENSTINE. I will take it real quick. There are a lot of seams here that are critically important. As you mentioned, if you are going to get to space, you are going to have to go through the National Airspace System, number one. Then when you get to space, eventually you are going to potentially de-orbit if you are in low Earth orbit.

And so in each of these cases, you are going to be taking advantage of the National Airspace System. One of the challenges that we have right now is when a launch occurs, the National Airspace System for a geographic region gets shut down for a number of hours and commercial air traffic has to go around it. And it costs a lot of money and puts a big burden on industry.

We want that to shrink. So whether it is launch or a whole host of other activities, Commerce is going to have to work with FAA and vice versa. And so these seams have to be really well thought out and we need to prepare for them, but that is going to happen regardless of where it is. Commerce and FAA are going to have to work together to make it happen.

Mr. MITCHELL. Agreed. My concern was, I admit, I sit on TI [Transportation and Infrastructure Committee], and I am on the Aviation Subcommittee.

Mr. BRIDENSTINE. There you go.

Mr. MITCHELL. I didn't see here, and I would encourage some description of how actually you engage with the FAA on this because I think there is, not just launch, but, in fact, failure of a launch, that area needs to be closed. All the risks and factors affect that civil aviation, that airspace now.

General, do you have anything you wish to add to that, sir?

General HYTEN. So I agree with the administrator. The key there is when it comes to space, every element of the government is involved. Some in big ways, some in small ways, which means there is always going to be seams. So the way you handle seams is with clear authorities and responsibilities. And the authority to the Secretary of Defense is to defend the Nation. The authority to the Commerce is to promote commerce.

Now, you have to decide, for this space traffic management, where is the best place to put the authority? The administration

has decided the Department of Commerce is the best place to put that. But that doesn't mean that—the FAA still has a role, the Department of Defense still has a role, NASA still has a role. We all are going to have roles as we go through this, but we all have to align under some—because if we don't, we will just keep doing it.

Mr. MITCHELL. I appreciate that. And I would suggest that maybe a little more clarity, and I will share with Secretary Ross as well, in terms of what those seams are and that role of the FAA so that we don't end up losing something there. I think it would be critically important.

I appreciate your answers. And I yield back, Mr. Chair.

Mr. ROGERS. I thank the gentleman.

The Chair now recognize Mr. Beyer for 5 minutes.

Mr. BEYER. Thank you, Mr. Chairman. General, Administrator, thanks so much for being with us all morning.

Administrator Bridenstine, I am very impressed with the many things NASA is doing in the space. The new Space Fence radar; the NASA Orbital Debris Engineering Model which predicts what is coming in the next 30 to 35 years; the LEO-to-GEO [low Earth orbit to geosynchronous Earth orbit] Environment Debris model, LEGEND, which looks at what the environment is going to be like in 100 to 200 years.

Can you tell us what LEGEND tells us about this 100 to 200 year? Is space going to become ever more crowded and ever more dangerous?

Mr. BRIDENSTINE. Absolutely. So just to be clear, Space Fence is not a NASA project; it is a DOD project. But we certainly will benefit from it. I am a little concerned that we are going to learn about so much space debris that our astronauts are going to be sheltering in place a lot more than they are right now. In fact, we haven't sheltered in place since 2015.

Once we have more situational awareness on all the debris that is out there, it could—you know, once you know what you need to be worried about, you get more worried about it. So there is a concern there on my end.

Mr. BEYER. Administrator, let me ask you the most naive question of the morning. Is there anything we can do to collect the debris that is out there?

Mr. BRIDENSTINE. There are certain technologies that are being developed. NASA, of course, is involved in robotic servicing of satellites. It is a project we have right now underway that is called Restore-L, and we are going to service a Landsat-7 satellite, which is a good project.

But ultimately, if we want to do robotic servicing in a way that is beneficial to our country and game-changing, we need to develop robotic technologies that can then be licensed to a dozen companies, and each of those companies could have a dozen satellites in low Earth orbit doing robotic servicing of satellites. When we get to that position, it is absolutely possible that we could hire some of those commercial companies to remove orbital debris.

So that is certainly within the realm of possibility and a futuristic kind of thought, a futuristic kind of thinking about how to deal with the orbital debris population.

Mr. BEYER. It would certainly, if you look at that 30 to 35 years or 100 to 200 years. I am working on the assumption that mankind is going to put ever more debris up there year after year.

Mr. BRIDENSTINE. That is true. It is also true that the biggest risk to missions in low Earth orbit, the biggest risk is from objects that are too small to even track. So we can kind of create a statistical model as to what the environment looks like and create probabilities about how long a satellite can last in low Earth orbit, given the pelting that it is going to receive from debris, and how much shielding it might need to have.

So we can create those statistical models. But ultimately, the biggest risk is from objects that we can't even track right now. So it is going to be hard to remove them if we don't know that they are there specifically.

Mr. BEYER. Mr. Administrator, I know you have a hard science background with your triple major at Rice. Is there any value to the orbital degradation of the stuff or is it just too small to have the orbits degrade in our lifetimes?

Mr. BRIDENSTINE. Oh, they do degrade, especially in low Earth orbit. There is trace atmosphere. The gravity of the Earth is not uniform. And so we see a lot of these objects behaving in ways that sometimes are unanticipated.

I know Dr. Moriba Jah was here just a few minutes ago from the University of Texas. He talks about the fact that a lot of these objects in space that are not even trackable or the objects that are trackable, we model them as if they are all perfect spheres, and they are not. We model them as if they don't spin or maneuver, and they do. We model them as if the Earth's gravity is perfectly uniform, and it's not.

So there is a lot we need to learn about orbital debris and how it behaves so that ultimately we can get better data to ultimately make predictions and characterizations that can protect our assets and property.

But you are hitting some very key points, which are it is a dangerous environment, we need to do the best we can to characterize that environment, and ultimately we need to be able to detect objects that are smaller than 10 centimeters, which is what we can do right now.

Mr. BEYER. Let me ask you a small but probably important budget question. In your testimony, you talked about the Conjunction Assessment Risk Analysis office—

Mr. BRIDENSTINE. Yes.

Mr. BEYER [continuing]. At Goddard, which I am sure you are very proud of, and that they have the primary role of checking 65 spacecraft, et cetera, et cetera. Its budget is \$4 million a year, and yet we know the rest of the things you are putting up there are billions of dollars. Are we spending enough money on the CARA office?

Mr. BRIDENSTINE. I think we are. Certainly, more money is better, but given the risk that we are seeing to our missions and their ability to assess those risks and then make determinations for maneuvers as necessary, I believe we are in a good position right now with the investments that we have.

Mr. BEYER. Thank you, Mr. Administrator.

I yield back, Mr. Chairman.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes the gentleman from Florida, Mr. Dunn, for 5 minutes.

Mr. DUNN. Thank you, Mr. Chairman.

Administrator Bridenstine, Jim, it is great to see you here. I have a couple of questions about the services currently provided. So the Space Policy Directive reaffirmed the basic collision avoidance information services are and should continue to be provided free of user fees. Can you confirm that that is so going forward?

Mr. BRIDENSTINE. That is a big objective, again, because it is important for the United States of America to be preeminent here in this capability, and we want companies to locate in the United States believing that they are going to have these kind of services available through a civil agency. So I believe basic SSA is important for the safety of the space environment in general.

Mr. DUNN. As do my constituents.

Mr. BRIDENSTINE. Okay, good.

Mr. DUNN. In that same vein, if the government contracts with a private company to provide space situational awareness functions, in that situation will the data and the analytics continue to be available and will the raw data be available in repository form so that civilian companies can perform their own analytics?

Mr. BRIDENSTINE. So that is a wonderful question and not an easy one, but eventually the way I think it is going to go is there is going to be a basic SSA kind of capability that is available to everybody, and it will be without fee, which I think is important.

But there are also going to be private companies that are going to want to give advantages to other private companies operating in space. And in order to provide that advantage, they are going to license their data to a private company and the U.S. Government might not have access to that.

So that presents an opportunity for commercial companies to augment data and get better resolution, higher resolution. And really in a free market, you know, the United States Government can't confiscate that data.

So I think there is going to be an architecture that is going to have a basic SSA capability, and then there are also going to be commercial companies that can come alongside and provide that to operators, maybe in their model. Other people might want to develop sensors and data and sell it directly to the government. That might be a model as well.

Mr. DUNN. So specifically, can you address the raw data that the government currently gathers? Would that raw data be available to private companies?

Mr. BRIDENSTINE. It would be available to the public. Any government data would be available to the public. And right now, that data generally comes from STRATCOM through the JSpOC.

Mr. DUNN. Let me ask you. Maybe I should have asked the general, he is holding that. But let me ask, what was the rationale for assigning the Department of Commerce, not NASA, as the lead civil agency for space situational awareness?

Mr. BRIDENSTINE. So NASA is an agency that does science and technology. We do discovery. We do exploration. What we don't do is regulate. That is historic—

Mr. DUNN. I think that is good. I just wanted to get you on record, because I actually agree with that decision. I just wanted to get it out.

General Hyten, space is being designated as a warfighting domain as well as a commercial domain. Where do you see the trend in space control sort of evolving for DOD in space situational awareness?

General HYTEN. It is interesting, because as the combatant commander with space as my joint operating area, I actually have two priorities and some people think they conflict.

Priority number one is to defend this Nation against all threats. That means I have to be able to watch any threat, deal with any threat, defeat any threat. And I do that.

But I also have an implied task that says I have to make sure that the space environment is safe for the future, because anything bad that happens in space, it is not like we were talking about cleaning up the environment a while ago. It is not like you can just go out right now and clean it up. You know, if you have a collision in space, the impacts are forever. So there is an implied task that I have to be able to operate safely in order to do that.

That is why for the last 9 years we have stepped up to the job of providing that for the world. We will continue to do that until, hopefully, the Department of Commerce steps up in the near term to do that for us, because it is in our interest as a Nation to have a secure space environment.

Mr. DUNN. I couldn't agree with you more, and I think you have done a great job. I hope you continue to have a great presence there.

A comment. I was looking when I saw that Space Policy Directive Number 3 came out, I said, what were 1 and 2? So I had a chance to go back and look at that. And, you know, the SPD-1 was let's go to the moon and Mars. SPD-2 was let's streamline the space regulatory environment. And now I am looking at SPD-3 and I am looking at all the things it addresses, and my staff summed that up well for me. They said, just make space great again.

Thank you very much, Mr. Chairman. I yield back.

Mr. ROGERS. I thank the gentleman.

The Chair now recognizes Mr. Foster for 5 minutes.

Mr. FOSTER. Thank you to our witnesses, and congratulations to Administrator Bridenstine.

Mr. BRIDENSTINE. Thank you.

Mr. FOSTER. Nice to have you back. I would like, if you could, to speak a little bit about how you are viewing the international governance and enforcement of space commerce. You know, the United States is not alone. I think it's, you know, the rest of the world has roughly a comparable number of orbiting devices and that ratio is going to change over time.

And so do you anticipate a future where every country pretty much goes its own way and regulates its own commerce and we have to worry about a race to the bottom for the lowest level of regulation which will be the lowest cost for multinational corporations,

or do you anticipate that the U.S. regulator will serve underneath and be potentially overridden by an international body with regulation over all space activities?

Mr. BRIDENSTINE. That is a great question, Congressman. Currently, in some orbital regimes, the International Telecommunications Union, the ITU, which is a part of the United Nations, does license orbital slots for the international community. And, of course, American companies are involved in getting their orbital slots from the ITU. The ITU is also involved in allocating spectrum for commercial operators. So there is already an international component there.

Maybe where at this point it is insufficient is what is happening largely in low Earth orbit, where there is a whole lot more debris and a whole lot more risk, I should say.

And the answer is, right now there isn't that kind of international oversight in low Earth orbit the way there is in geostationary orbit. And what I would say is I think the direction we should go is we should set those standards, and NASA has a history of doing this.

Mr. FOSTER. Right. But there is the enforcement problem when someone goes to a country that is not setting those standards, puts stuff up in space. Who says no and how is that enforced?

Mr. BRIDENSTINE. It is done through the ITU, which is—

Mr. FOSTER. I mean, look at the South China Sea, right?

Mr. BRIDENSTINE. Right. No, that is right.

Mr. FOSTER. You know, an international body clearly spoke and said that is not an acceptable activity, and a certain country that will remain nameless sort of is ignoring that. When that recurs in space, what is the scenario here that you are thinking of?

Mr. BRIDENSTINE. So as a pilot in the Navy, I used to operate in the Persian Gulf, and we would get challenged by various countries and they would say, you are operating in the wrong part of the world or whatever.

And we would always go back and say, under ICAO procedures, the International Civil Aviation Organization, that we were a sovereign U.S. aircraft operating in international airspace, due regard. And that word "due regard" is ultimately what protects us from challenges from the international community.

And I would argue that, you know, as it relates to us right now in space, we operate due regard. And I would say that as time goes on, American leadership might need to be a little stronger here so that ultimately we don't have collisions that beget more collisions.

Mr. FOSTER. Okay. But what happens when two countries start fighting over mining the same asteroid or things like that? You know, is there any alternative to an international governance organization? And if there is not, why are we not prioritizing that first, to get that structure in place and get the U.S. regulators plugged into it?

Mr. BRIDENSTINE. I think the model that we utilize right now—and, of course, this is established through the Outer Space Treaty, where—

Mr. FOSTER. Many countries are not signatories to the Outer Space Treaty, they have not ratified it, important countries, you know, like China, like others I could name.

Mr. BRIDENSTINE. Sure. So certainly that requires international pressure to get them to conform to the international standards.

Mr. FOSTER. So is your concept here that U.S. regulation will be secondary to international regulation, or that we are just going to go make up our own rules?

Mr. BRIDENSTINE. I think we adhere to the treaties that are currently in place, specifically the Outer Space Treaty. And as long as, you know, we are operating under the obligations of our international treaty—

Mr. FOSTER. Right. Which are incomplete and there will have to be detailed regulations. For example, if you look at cybersecurity, you can't have people put up swarms of satellites without enough cybersecurity that ensures they can't be hacked and use their station-keeping ability to go and, you know, knock out the ISS, or any of these sort of scenarios.

There will have to be international standards on, for example, cybersecurity for any satellite with station-keeping ability. Okay. And there will be different—countries will have different opinions on that. If some country thinks that the U.S. standards are not high enough and we say no, that is too expensive, how do you anticipate that that decision will be handled?

Mr. BRIDENSTINE. So as far as your earlier suggestion that if we mine an asteroid and maybe somebody else wants to mine the same asteroid and that could result in a dispute, I think the odds of that are exceptionally small, but I think also at the same time we can operate due regard. And whoever extracts the resource has the rights to the resource under the Outer Space Treaty, which we are signatories to.

Mr. FOSTER. All right. Well, I guess my time is up here. But, you know, I really urge you to think more about the international—you know, the idea that America acting alone is a reasonable model to proceed is not going to work. You know, 50 years from now, the majority of objects in orbit are not going to be U.S. objects and we are not going to dominate space in the long term, and we should start planning for that and accept it rather than just pretending like the world is not changing.

Mr. BRIDENSTINE. I would argue that we are in compliance with our obligations under the Outer Space Treaty and other treaties, and that ultimately we will—

Mr. FOSTER. Yeah, but we have to get all the countries on Earth to do this or it is not going to be too meaningful. And that is the thing that worries me. And we have to start by strengthening those agreements and making them uniform, and I don't see a lot of effort on this administration in plugging into a strong international regulatory regime.

Mr. BRIDENSTINE. There isn't a strong international regulatory regime.

Mr. FOSTER. And that should be prioritized.

I am over my time. I yield back.

Mr. BRIDENSTINE. And so we need to have American leadership.

Mr. ROGERS. The gentleman yields back.

And that brings us to the conclusion of this hearing. I did want to point out that we had members having to come and go. So some members may have some questions they need to get to you all. So

we are going to leave the record open for 10 days, if you could respond to those in writing.

And also make note of something else. This is a very important area of interest, and that is demonstrated by the fact that we had 30 Members of Congress participate in this joint subcommittee hearing today, many of whom weren't even on the two subcommittees. And combined with if you went outside, 2 hours before this hearing the line started forming to get in here. That usually only happens when the chiefs are here or the Secretary. People care about what you do. And we are very proud that we have got two competent individuals such as you serving in the roles that you have.

So thank you for being here. It has been very helpful. This hearing is adjourned.

[Whereupon, at 11:16 a.m., the subcommittees were adjourned.]

A P P E N D I X

JUNE 22, 2018

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

JUNE 22, 2018

Statement by Chairman Lamar Smith
HASC Strategic Forces Subcommittee and HSST Space
Subcommittee Joint Hearing
“Space Situational Awareness: Whole of Government
Perspectives on Roles and Responsibilities”
09:00 a.m. on Friday, June 22, 2018

Mr. Chairman, let me start by thanking my Armed Services Committee colleagues, Chairman Mac Thornberry, Ranking Member Adam Smith, Chairman Mike Rogers, and Ranking Member Jim Cooper for collaborating on this joint hearing.

Space situational awareness has dramatic civil, commercial, and national security implications. NASA, the Department of Commerce, the Department of Defense, and the private sector all play important.

The House Science, Space, and Technology Committee has held a number of hearings on this topic, with testimony provided by civil, commercial, and national security experts.

But today is the first time our two Committees have jointly held a hearing on this crucial topic. And our timing couldn't be better.

Earlier this week, President Trump presented and signed National Space Policy Directive 3 at a National Space Council ceremony at the White House. This Directive establishes new national policy for space situational awareness and space traffic management.

The President's proposal for the Department of Commerce to take the lead in space situational awareness and space traffic management is good policy. The department's newly expanded space team and commercial space-related functions present the ideal environment for this responsibility. Unlike in past generations, activity in space is becoming largely commercial. Commerce is uniquely positioned to ensure that innovation, investment, and private sector leadership

will have a prominent place in any future space traffic management framework.

Granting the Department of Commerce this authority is consistent with the policy of the *American Space Commerce Free Enterprise Act*, which passed the House by a voice vote this April. It also complements regulatory responsibilities assigned to the Commerce Department under National Space Policy Directive 2.

I look forward to Secretary Ross's testimony this morning to learn more details about how the Department of Commerce will execute this responsibility.

I recognize that transitioning the DoD responsibilities to Commerce will impact government and non-governmental customers of DoD's existing service. This is why it is critical that the Administration take all necessary actions to ensure that current levels of services are, at a minimum, maintained during the transition.

No discussion of America's future in space is complete without including NASA. NASA has accumulated vast technical, engineering, and scientific expertise relevant to space situational awareness. NASA's expertise should be leveraged, on a reimbursable basis, to support the Department of Commerce. It will take a cooperative effort to meet the challenges and ensure American leadership in this field. Our former colleague and American Space Commerce bill co-author, now NASA Administrator Jim Bridenstine, will make this happen I have no doubt. Welcome Jim.

Finally, let me highlight the major developments occurring in the private sector. In the past, applied space situational science and technology development was solely the responsibility of the government and the national security industrial base. No longer. Today, the private sector is conducting independent research and developing

new technologies to address civilian needs. We should foster such research and development and support the transition of private innovation to the marketplace.

I thank our witnesses for appearing today and look forward to their testimony.

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Statement by Subcommittee Chairman Brian Babin
Science, Space, and Technology Space
Joint Hearing HASC Strategic Forces and HSST Space
Subcommittee Hearing
“Space Situational Awareness: Whole of Government
Perspectives on Roles and Responsibilities”
09:00 a.m. on Friday, June 22, 2018

Thank you Chairman Rogers. I appreciate the opportunity to collaborate on today’s joint hearing and look forward to working together on this and other issues.

Space situational awareness, and the related question of space traffic management, is an important and timely topic. One of the reasons is that American industry is investing in and operating more satellites and spacecraft in space than any other time in history. Indeed, America’s future in space looks prosperous because our industry is leading a new era of private space activities. As more and more actors proliferate the Earth’s orbital regimes, knowing where and when spacecraft will

be moving and being able to coordinate in order to avoid collisions, is critical to ensuring a sustainable operational environment for all.

On Monday, I was at the National Space Council meeting as President Trump signed Space Policy Directive 3, a National Space Traffic Management Policy. SPD-3 is the first ever national policy to address space situational awareness (SSA) and space traffic management. Through this policy, America is leading the world in addressing this long-standing and rapidly growing issue.. I applaud President Trump for his leadership on this important topic.

Last year, I co-sponsored, along with Chairman Lamar Smith and then Representative Jim Bridenstine, the *American Space Commerce Free Enterprise Act*. This Act directs the Department of Commerce to be responsible for

authorizing and supervising in-space activities, in a minimally burdensome way. Part of this Act includes provisions on space debris mitigation and space traffic management consultations. In fact, the *Free Enterprise Act* laid the policy foundations for both National Space Policy Directive 2 and 3.

Space Policy Directive 3 takes the policy principles of the *Free Enterprise Act*, including establishing the Department of Commerce as the lead agency, and builds upon them. I strongly support the Department of Commerce as the lead agency and I am glad the President agrees.

As we look at the President's policy and reflect upon the need for legislation, there are several important related policies that Congress should support.

First, there is a need for federal science and technology investments to be coordinated and

leveraged to support space situational awareness and space traffic management.

Second, the Department of Commerce's space situational awareness program should be designed to be flexible,

Third, as the Department of Commerce takes over public SSA services, we need to ensure there is a continuation of basic SSA services that DoD currently provides with no break in service or erosion in quality.

Fourth, the Commerce Department should establish a SSA data test bed to allow for private and public-sector access to the underlying SSA data used to provide services.

Lastly, the Department of Commerce must receive an appropriate level of funding from Congress to carry out its new mission.

There has been a great need for leadership in these matters. I am proud that the United States has taken this opportunity to lead the world in the development of a civil space situational awareness and space traffic management framework.

I understand that Secretary Ross went to great lengths to be available to testify this morning – I thank him and all of our witnesses for appearing and look forward to their testimony.

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HOUSE ARMED SERVICES SUBCOMMITTEE ON STRATEGIC FORCES
HOUSE SCIENCE, SPACE, AND TECHNOLOGY SUBCOMMITTEE ON SPACE

STATEMENT OF
JOHN E. HYTEN
COMMANDER
UNITED STATES STRATEGIC COMMAND
BEFORE THE
HOUSE ARMED SERVICES
STRATEGIC FORCES SUBCOMMITTEE
AND
HOUSE SCIENCE, SPACE, AND TECHNOLOGY
SPACE SUBCOMMITTEE
22 JUNE 2018

HOUSE ARMED SERVICES SUBCOMMITTEE ON STRATEGIC FORCES
HOUSE SCIENCE, SPACE, AND TECHNOLOGY SUBCOMMITTEE ON SPACE

INTRODUCTION

USSTRATCOM is a global warfighting command, setting the conditions across the globe as the ultimate guarantor of national and Allied security. Our forces and capabilities underpin and enable all Joint Force operations.

USSTRATCOM forces are globally-dispersed from the depths of the ocean, on land, in the air, and into space, with a matching breadth of mission areas. Nearly 162,000 Soldiers, Sailors, Airmen, Marines, and Civilians are responsible for Strategic Deterrence, Nuclear Operations, Space Operations, Joint Electromagnetic Spectrum Operations, Global Strike, Missile Defense, and Analysis and Targeting. These critical mission areas are an integral part of our combat operations, which enables warfighters across all domains to preserve the peace and when called upon, dominate in conflict and win.

USSTRATCOM conducts strategic planning, warfighting operations, aids the President's nuclear response decision-making process, provides global situational awareness to the National leadership and combatant commands, and, when necessary, is prepared to deliver a decisive response in all domains.

The focus of USSTRATCOM remains to deter strategic attack on the United States and its Allies. We stand ready to respond to threats anywhere, anytime across the globe. We acknowledge that we cannot do this alone and must continually work towards enhancing our alliances and partnerships, in all areas.

Today, deterrence is more than just our nuclear capabilities. Deterrence requires integrated planning for all capabilities, across all domains, including space. This enables synchronized operations and decisive responses to adversary aggression anytime, anywhere. We must make the concept of integration operational for all domain warfighting throughout the Department of Defense.

In particular, we must normalize space as a warfighting domain. There is no war in space. There is only war, and war can extend into any domain. To fight wars in these domains we must develop the appropriate rules of engagement that allow for rapid response and delegate authority to the appropriate level to operate more quickly.

GLOBAL SECURITY ENVIRONMENT

Space was once an exclusive frontier accessible to few. Today, the barriers to entry into space are relatively low. Technology advancements and access to, through, and from space enable

participation by almost any nation with the will. Although our ability to operate within the space domain is not an issue today, congestion and threatening activities are becoming increasing concerns.

Not all are committed to the responsible and sustainable use of space. Russia and China continue to strengthen its military space capabilities and pursue counterspace capabilities to limit and prevent U.S. access to space systems, which are critical for modern military engagement. We anticipate that Russian and Chinese counterspace systems will be able to hold U.S. satellites in every orbital regime at risk within the foreseeable future. Iran and North Korea have and are pursuing counterspace weapons, but not as aggressively and not as advanced (limited to GPS and SATCOM jammers).

These adversary trends present challenges to the safety, stability, and sustainability of U.S. space operations. Adversaries believe they can erode the U.S.'s economic and strategic advantage by disrupting and/or destroying U.S. (and our Allies and Partners) satellites providing space-based capabilities essential to our economic vitality and national security. The U.S., specifically USSTRATCOM in coordination with the Intelligence Community, is responsible for detecting, assessing, and if necessary defending against threats to U.S. Government (USG) satellites.

SPACE SITUATIONAL AWARENESS

Space Situational Awareness (SSA) is the foundation upon which USSTRATCOM maintains spaceflight safety, provides warning, and assesses intentions of adversary actions towards U.S., Allies, and Partner satellites. There is a fundamental need to perform surveillance and reconnaissance to understand the space environment and support decision-making by many – not just the military. Space surveillance and reconnaissance, coupled with foundational and operational intelligence, forms our SSA operating picture. SSA provides decision makers indications and warning of hazards and threats: natural and manmade; non-hostile or hostile. SSA also underpins efforts to preserve, protect, and defend assets in space to include manned spaceflight and activities supporting safe management of space traffic – fostering access to, and responsible use of, space for all.

The Department tracks over 20,000 objects in space and that number is growing annually – over 600 new satellites estimated in 2019, many difficult to track, including cube-sats and micro-sats. It is imperative the Department continues to maintain exquisite SSA given the defense implications for the nation. Currently, the Department publishes a catalog of these space objects

and makes potential collision notifications for global users free of charge. We will see an increase in tracked objects as more nations pursue space capabilities and we improve our ability to detect and identify smaller objects. As the number of space objects increases, our current advisory activities and architecture will become inadequate. At the same time, the contested nature of operations in space is increasing the demand on Department resources for protecting and defending U.S. and Allied space assets.

SSA MILITARY REQUIREMENTS

Maintaining the benefits afforded to the U.S. by space is a cornerstone of our national security, however, an evolving strategic environment increasingly challenges U.S. space advantages. As part of the requirement to meet this challenge, USSTRATCOM currently conducts SSA operations for:

- USG, U.S. commercial space capabilities, and services used for national and homeland security purposes;
- U.S. civil space capabilities and operations, particularly human space flight activities; and
- Non-U.S. commercial and civil space entities as appropriate.

In addition to safety of flight, we specifically conduct SSA operations to support:

- Awareness of adversary use of space and their potential impacts to terrestrial or space services.
- Attribution necessary for deterrence, or dissuasion, of adversary threats or execution of harmful space actions.
- Denial or prevention of adversary capabilities which might impact space services or terrestrial operations when deterrence fails.
- Assured delivery of communication; position, navigation, and timing; intelligence, surveillance, and reconnaissance (ISR); missile warning; and weather in support of diplomatic, informational, military, and economic national objectives.
- Implementation and verification of international treaties and agreements.

These requirements dictate the need for systems that can provide surveillance and reconnaissance over a large volume of space; for an ever-increasing number of space objects (active satellites and inert debris); and, more important, a level of speed and precision necessary to support warfighting operations. There is unprecedented growth in manned and unmanned

spaceflight. Our adversaries are making significant and rapid investments in military space programs. Meanwhile, our space warfighters are called on to preserve U.S. freedom of action in the space domain by detecting, identifying, tracking, characterizing, and predicting the motion of objects that are increasing in number and decreasing in size. The Department requires dedicated and supplemental systems that can provide persistent awareness of objects which pose a threat to high value capabilities (U.S. and Allied) and support actions to include executing protective measures against active threats, detecting and identifying launches, predicting re-entry, resolving anomalies, and attributing hostile actions.

The Department provides SSA data and services to space-faring nations, to include military-to-military data sharing, through direct interactions with the Joint Space Operations Center (JSpOC) at Vandenberg, AFB and a public website called 'Space-track.org.' The 'Space-track.org' website provides SSA data for a rudimentary understanding of where manmade objects are in space. The JSpOC interfaces directly with governments and commercial entities to warn and facilitate prevention of collisions in space. Next month, July 2018, we will begin transitioning the JSpOC to the Combined Space Operations Center (CSpOC) to integrate Allied and partner capabilities in specified mission areas to fill capability gaps.

This commercial and government-to-government activity is not an inherently-military function. As of Monday, with President Trump's signing of Space Policy Directive-3, the Administration's position is to transfer a portion of this function to the Department of Commerce in order to free up USSTRATCOM resources to conduct the inherently-military mission of protecting USG satellites and interests in space, while continuing to conduct SSA operations in support of national security objectives. I support this initiative. USSTRATCOM will partner with the Department of Commerce to support its mission to interface with commercial and civil users, as well as the public in general, by providing its SSA generated from reliable data sources. Sources of data will not only come from long-standing U.S. military space surveillance assets, but may also come from allies and other partners – commercial and non-commercial alike.

SSA SHARING AND SERVICES

Title 10 U.S.C § 2274 authorizes the Secretary of Defense to provide SSA services and information to non-USG entities free of charge. Under this statute, USSTRATCOM has led the negotiation, coordination and signing of 16 government level agreements and 68 commercial SSA

agreements. USSTRATCOM provides three tiers of services to the public, allies, and other partners:

- Emergency services: The emergency service includes conjunction¹ data messages to virtually all satellite owners/operators; including Russia and China. This information helps satellite owner/operators avoid collisions in space.
- Basic services: The second level of service, basic services, requires a user account agreement to access information in the 'Space-track.org' website. These services include satellite catalog two-line element sets, reentry assessments, and recent cataloged and decayed objects.
- Advanced services: USSTRATCOM can provide seven advanced services upon request, in addition to basic services, to those nations and commercial partners with signed SSA sharing agreements – satellite anomaly resolution, collision avoidance support, conjunction assessment², deorbit and reentry support, end-of-life and disposal support, launch support, and electromagnetic interference investigation.

CAPABILITIES

The current Space Surveillance Network (SSN) is a worldwide "system of systems" of tracking and detection radars, imaging radars, and optical telescopes operated by military, intelligence, and civilian organizations. The ground-based SSN is augmented by imaging satellites to provide critical data on the space domain and environment. A large portion of the capabilities and locations are, for the most part, the result of non-space surveillance requirements (e.g. air and missile warning). In other words, for much of the '80s, '90s, and even early 2000s our SSA capability was primarily the result of leveraging other missions' assets to perform space surveillance activities on a non-interfering basis. Though far from perfect, this resulted in an SSA capability that adequately met our flight safety needs in a benign space environment. Now that space is no longer a sanctuary, we are optimizing our SSA capability to meet the growing challenges of a warfighting domain.

¹ A conjunction is a close approach between space objects

² Conjunction Assessment is the process of predicting and reporting the close approaches between space objects. Conjunction Assessment information may include, but is not limited to, time of closest approach, predicted "miss distance" information, and position uncertainty information on the primary and secondary object. Conjunction Assessment excludes the process of determining and implementing courses of action to avoid on-orbit collisions.

In light of the requirements outlined above, the Air Force and the National Reconnaissance Office (NRO) are developing capabilities (sensors and supporting ground analytic architectures) to deliver on advanced situational awareness capability vital to USSTRATCOM's operations and the protection of our nation's critical on-orbit capability. As part of that advancement, we look forward to the near-term delivery of the first Space Fence, the future launch of the joint, Air Force and NRO, on-orbit indications and warning platform (Silent Barker), and continued investments in deep-space radars (Deep-space Advanced Radar Concept). We continue to refine and upgrade existing ground-based radars, telescopes stationed around the globe and employ the Geosynchronous SSA Program (GSSAP) satellites already on orbit in support of SSA. Additionally, we are increasing our interagency and international collaboration through the National Space Defense Center and the soon to be stood-up CSPoC.

CONCLUSION

USSTRATCOM is committed to strengthening relationships with our USG, Allied, and Commercial partners to ensure the U.S. retains the superiority in space on which our Nation's economic and national security relies. We will continue to provide the critical national SSA capabilities essential to national security and support efforts to transition support functions to the Department of Commerce. I thank the Committees for their continued support as we work through the challenges of operationalizing space and preserving the availability for all of those who chose to use space responsibly and peacefully.

General John E. Hyten

Gen. John E. Hyten is Commander of U.S. Strategic Command (USSTRATCOM), one of nine Unified Commands under the Department of Defense. USSTRATCOM is responsible for the global command and control of U.S. strategic forces to meet decisive national security objectives, providing a broad range of strategic capabilities and options for the President and Secretary of Defense.

General Hyten attended Harvard University on an Air Force Reserve Officer Training Corps scholarship, graduated in 1981 with a bachelor's degree in engineering and applied sciences and was commissioned a second lieutenant. General Hyten's career includes assignments in a variety of space acquisition and operations positions. He served in senior engineering positions on both Air Force and Army anti-satellite weapon system programs.

The general's staff assignments include tours with the Air Force Secretariat, the Air Staff, the Joint Staff and the Commander's Action Group at Headquarters Air Force Space Command as Director. He served as mission director in Cheyenne Mountain and was the last active-duty commander of the 6th Space Operations Squadron at Offutt AFB, Nebraska. In 2006, he deployed to Southwest Asia as Director of Space Forces for operations Enduring Freedom and Iraqi Freedom. General Hyten commanded the 595th Space Group and the 50th Space Wing at Schriever AFB, Colo. Prior to assuming command of Air Force Space Command, he served as the Vice Commander, Air Force Space Command.

EDUCATION

1981 Bachelor's degree in engineering and applied sciences, Harvard University, Cambridge, Mass.
 1985 Master of Business Administration degree, Auburn University, Montgomery, Ala.
 1985 Distinguished graduate, Squadron Officer School, Maxwell AFB, Ala.
 1994 Distinguished graduate, Air Command and Staff College, Maxwell AFB, Ala.
 1999 National Defense Fellow, University of Illinois, Champaign
 2011 Senior Managers in Government Course, Harvard University, Cambridge, Mass

ASSIGNMENTS

1. November 1981 - December 1985, Configuration Management Officer and Chief, Configuration Management Division, Automated Systems Program Office, Gunter AFB, Ala.
2. December 1985 - July 1989, Chief, Software Development Branch; and Chief, Engineering and Acquisition Division, Space Defense Programs Office, Los Angeles AFB, Calif.
3. August 1989 - July 1990, Special Adviser to the U.S. Army, Kinetic Energy Anti-Satellite Program Office, U.S. Army Strategic Defense Command, Huntsville, Ala.
4. July 1990 - August 1991, Deputy for Engineering, Strategic Defense Initiatives Program Office, Los Angeles AFB, Calif.
5. August 1991 - May 1992, Executive Speechwriter and Systems Analyst, Assistant Secretary of the Air Force (Acquisition), the Pentagon, Washington, D.C.
6. May 1992 - July 1993, Program Element Monitor, Advanced Technology Programs, Assistant Secretary of the Air Force (Acquisition), the Pentagon, Washington, D.C.
7. July 1993 - June 1994, Student, Air Command and Staff College, Maxwell AFB, Ala.
8. July 1994 - June 1996, Mission Director, Space Operations Officer, and Chief, Command Center Training, U.S. Space Command, Cheyenne Mountain Air Force Station, Colo.
9. August 1996 - August 1998, Commander, 6th Space Operations Squadron, Offutt AFB, Neb.
10. August 1998 - June 1999, National Defense Fellow, University of Illinois, Champaign
11. June 1999 - June 2001, Operations Officer, and Chief, Space Branch, Defense and Space Operations Division, Deputy Director for Operations (Current Readiness and Capabilities), J3, Joint Staff, the Pentagon, Washington, D.C.
12. June 2001 - June 2003, Chief, Space Control Division, Directorate for Space Operations and Integration, Deputy Chief of Staff for Air and Space Operations, Headquarters U.S. Air Force,

Washington, D.C.

13. June 2003 - July 2004, Director, Commander's Action Group, Headquarters Air Force Space Command, Peterson AFB, Colo.

14. July 2004 - April 2005, Commander, 595th Space Group, Schriever AFB, Colo.

15. April 2005 - May 2007, Commander, 50th Space Wing, Schriever AFB, Colo. (May 2006 - October 2006, Director of Space Forces, U.S. Central Command Air Forces, Southwest Asia)

16. May 2007- September 2009, Director of Requirements, Headquarters Air Force Space Command, Peterson AFB, Colo.

17. September 2009 - February 2010, Director, Cyber and Space Operations, Directorate of Operations. Deputy Chief of Staff for Operations, Plans and Requirements, Headquarters U.S. Air Force, Washington, D.C.

18. February 2010 - August 2010, Director, Space Acquisition, Office of the Under Secretary of the Air Force, the Pentagon, Washington, D.C.

19. September 2010 - May 2012, Director, Space Programs, Office of the Assistant Secretary of the Air Force for Acquisition, Washington, D.C.

20. May 2012 - Aug 2014, Vice Commander, Air Force Space Command, Peterson AFB, Colo.

21. Aug 2014 - Oct 2016, Commander, Air Force Space Command, Peterson AFB, Colo.

22. Nov 2016 - present, Commander, U.S. Strategic Command, Offutt AFB, Neb.

SUMMARY OF JOINT ASSIGNMENTS

1. July 1994 - June 1996, Mission Director, Space Operations Officer, and Chief, Command Center Training, U.S. Space Command, Cheyenne Mountain Air Force Station, CO., as a major

2. June 1999 - June 2001, Operations Officer, and Chief, Space Branch, Defense and Space Operations Division, Deputy Director for Operations (Current Readiness and Capabilities), J3, Joint Staff, the Pentagon, Washington, D.C., as a lieutenant colonel

BADGES

Master Space Operations Badge

Master Cyberspace Operator Badge

MAJOR AWARDS AND DECORATIONS

Distinguished Service Medal with oak leaf cluster

Legion of Merit with oak leaf cluster

Defense Meritorious Service Medal with two oak leaf clusters

Meritorious Service Medal with four oak leaf clusters

Air Force Commendation Medal

Army Commendation Medal

Joint Service Achievement Medal

Air Force Achievement Medal

OTHER ACHIEVEMENTS

1991 Recipient of the William Jump Award for Excellence within the Federal Government

1998 Recipient of a Laurels Award, Aviation Week and Space Technology Magazine

2009 Gen. Jerome F. O'Malley Distinguished Space Leadership Award

PUBLICATIONS

"A Sea of Peace or a Theater of War: Dealing with the Inevitable Conflict in Space," The Program in Arms Control, Disarmament, and International Security Occasional Paper, University of Illinois, 2000

"A Sea of Peace or a Theater of War," Air and Space Power Journal, Air University Press, 2002

"Moral and Ethical Decisions Regarding Space Warfare," with Dr. Robert Uy, Air and Space Power Journal, Air University Press, 2004

EFFECTIVE DATES OF PROMOTION

Second Lieutenant Aug. 23, 1981

First Lieutenant Aug. 23, 1983

Captain Aug. 23, 1985

Major May 1, 1993
Lieutenant Colonel Jan. 1, 1997
Colonel June 1, 2002
Brigadier General Oct. 1, 2007
Major General Nov. 10, 2010
Lieutenant General May 18, 2012
General Aug. 15, 2014

(Current as of November 2016)

HOLD FOR RELEASE
UNTIL PRESENTED
BY WITNESS
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Statement of
James F. Bridenstine
Administrator
National Aeronautics and Space Administration
before the
Subcommittee on Strategic Forces
Committee on Armed Services
U. S. House of Representatives
and
Subcommittee on Space
Committee on Science, Space and Technology
U. S. House of Representatives

Chairman Rogers, Chairman Babin, Ranking Member Cooper, Ranking Member Bera, and Members of the Subcommittees, thank you for the opportunity to appear before you today to discuss Space Situational Awareness (SSA), particularly as it has to do with space object surveillance and tracking and orbital debris characterization. The space domain is becoming increasingly congested and contested, prompting the space community to recognize the need to establish a national space traffic management framework to enhance the safety, stability, and sustainability of operations in the space environment.

To address some of these challenges, at the February 21, 2018, meeting of the National Space Council, Vice President Pence directed the Executive Secretary of the Council to develop a whole-of-Government strategy for space traffic management. The President signed Space Policy Directive-3 on June 18, 2018. This policy will guide critical and much-needed progress for space traffic management. SPD-3 builds on our continued progress implementing SPD-1, which is galvanizing American space leadership by returning to the Moon with commercial and international partners, and SPD-2, which will create regulatory certainty for entrepreneurs to raise capital to grow the American economy in space. As we continue to thrive in space, we also have more people launching to orbit, and an increasingly complex universe of satellites overhead. SPD-3 provides guidelines and initiatives to ensure that America is a leader in providing a safe and secure environment as space traffic increases. Common sense space situational awareness and traffic management will be good for our economy and will help provide a more stable environment for the burgeoning space economy.

NASA's Current Space Situational Awareness Activities

NASA maintains a strong, cooperative relationship with the DoD on SSA issues. NASA uses SSA information from DoD to avoid collisions between its assets and other tracked objects in Earth orbit. The Conjunction Assessment Risk Analysis (CARA) office at NASA Goddard Space Flight Center and the

Human Space Flight Operations Directorate at the NASA Johnson Space Center comprise the NASA spaceflight safety functions. These NASA spaceflight safety functions currently maintain a direct interface with the U.S. Strategic Command's (USSTRATCOM) Joint Space Operations Center and the U.S. Air Force Space Command's 18th Space Control Squadron (18 SPCS), in order to ensure that the SSA needed for collision avoidance analysis is provided to NASA in a timely manner.

NASA does not create or maintain a catalog for SSA – i.e., NASA does not track detailed debris orbits, report where an object will be in the coming days, or compute close approach predictions. This activity is conducted by the DoD through the United States Space Surveillance Network (SSN), which detects, identifies, tracks, and catalogs human-made objects (e.g., active/inactive spacecraft, spent rocket bodies, or fragmentation debris) orbiting Earth as small as 10 cm in Low Earth Orbit (LEO) and objects as small as 1 m in Geosynchronous Earth Orbit (GEO). The SSN is the responsibility of the USSTRATCOM Joint Force Space Component Commander.

Collision Avoidance

NASA depends upon DoD's SSA information to prevent its spacecraft from colliding with tracked objects in Earth orbit. NASA's spaceflight safety functions are mission-funded resources that perform risk assessment for their respective missions using software suites consisting of a combination of Commercial Off-the-Shelf and custom applications to analyze the close approach data provided by the 18 SPCS. These spaceflight safety functions maintain liaison with the 18 SPCS in order to ensure that the SSA needed for proper collision avoidance analysis is provided to NASA and that information regarding upcoming NASA spacecraft maneuvers is delivered to DoD in a timely manner.

Collision avoidance is a three-step process. The first step is conjunction assessment screening, which involves computing the predicted close approaches between NASA spacecraft and the 18 SPCS catalog of space objects. This step is performed for NASA at the 18 SPCS by either the NASA Orbital Safety Analysts (OSAs) for robotic missions or by 18 SPCS Human Spaceflight (HSF) OSAs for crewed missions. The second step is a risk analysis, in which NASA analyzes results from the first step to determine the level of risk posed by predicted close approaches and to further determine whether the operational risk warrants additional investigation or mitigation. The third step, if required, is mitigation, in which the mission operator plans, and perhaps executes, a collision avoidance maneuver or other mitigating action, often in coordination with the owner of the other space object. Not all NASA spacecraft have propulsion systems and can take action in this third step. In those cases, if the close approach is with an object that can maneuver, we will negotiate with the owners of that system to do so. If neither spacecraft can alter their trajectory, we monitor the conjunction until the danger has passed.

CARA provides spaceflight safety support to all Agency robotic missions. It funds a team of contract personnel, OSAs, who are embedded within the 18 SPCS. These NASA OSAs provide dedicated and focused support, ensure mission safety, and provide timely required SSA data streams back to CARA. They represent NASA's interests and protect NASA's robotic Earth-orbiting satellites. The OSAs have access to the 18 SPCS close-approach assessment systems, and they can produce specialized products for NASA missions. The OSAs are vested with the appropriate access and proficiencies to meet NASA mission needs and exigencies in a responsive manner. The current funding line for NASA CARA is approximately \$4 million per year. This covers the full CARA service for about 65 spacecraft, including operators, offline analysts, software developers, OSA staff at the Vandenberg AFB 18 SPCS facility, the hardware, the software licenses, documentation, training, system administration and IT security, and management.

For human spaceflight missions, the NASA teams in the Houston Mission Control Center perform both functions of risk assessment and operational response. Crewed spaceflight situation awareness services

are provided by Human Spaceflight (HSF) OSAs. These HSF OSAs are a team of 18 SPCS-provided civilian and military personnel providing around-the-clock conjunction assessment and other operational safety support to the Mission Control Center in Houston. These HSF OSAs also support other 18 SPCS functions such as catalog maintenance. Upon receiving alerts from the HSF OSAs at 18 SPCS, personnel in Mission Control assess the associated tracking and orbit predictions to determine the collision risk, and then coordinate an appropriate mitigation plan with the operations team, including international partners, as appropriate.

Each NASA spaceflight safety function provides automated updates to their missions regarding the risk posed by close approaches each time SSA data is received from the 18 SPCS. They also perform manual analysis to determine the risk posed by each predicted close approach based on several factors, including the quality of the close approach prediction for the secondary (conjuncting) object, which depends upon the tracking data that was used to compute the trajectory and predict the close approach. NASA develops and maintains state of the art models for computing probability of collision for close approaches. This risk analysis assists the project managers in developing mitigations to avoid collisions.

Orbital Debris Characterization

While collision avoidance and catalog maintenance are important, they do not entirely address the problem of orbital debris collision risk. For every object that is currently tracked and can be avoided, there are orders-of-magnitude more orbiting objects too small to be tracked that could do serious damage to NASA spacecraft. The new Space Fence radar being constructed by DoD will help address this problem by lowering the minimum object size being tracked, but most risks from non-trackable debris will remain. In fact, millimeter-sized orbital debris represents the highest penetration risk to most operational spacecraft in LEO. In addition, while collision avoidance is prudent for operational spacecraft, it is not a solution to the long-term degradation of the space environment due to future collisions. This is because the vast majority of potential collisions are between objects that cannot maneuver to avoid collisions, especially massive spent upper stages and retired spacecraft.

The NASA Orbital Debris Program Office (ODPO) has the responsibility to define the environment for debris too small to be catalogued by 18 SPCS, but still large enough to threaten missions. These debris are not tracked, but are measured using statistical techniques based on radar, telescope, and *in situ* measurement data to understand their size and orbit distribution, and to understand where they come from. The ODPO also creates and maintains modeling tools to understand the effects of debris on spacecraft risk and the long-term evolution of the debris environment.

For understanding the present and near-term environment, the ODPO has created the Orbital Debris Engineering Model (ORDEM), an empirically-based model that predicts the orbital debris environment for the next 30-35 years and is intended to be used by spacecraft designers and mission planners to assess the impact risk from orbital debris to a spacecraft over its on-orbit lifetime. These analyses using ORDEM provide spacecraft designers/operators with quantitative results for evaluating the risk that orbital debris poses to the success of their missions as well as providing a basis for evaluating quantitative methods of the cost effectiveness of various debris shielding techniques as well as operational techniques for mitigating damage from the debris impacts. ORDEM can be used to compute the average rate at which debris of various sizes might be expected to hit a spacecraft over its mission lifetime, but is not designed to evaluate the risk a particular tracked object will hit a particular space asset at a particular time.

The ORDEM model is also used in the Debris Assessment Software, a tool to assist spacecraft and mission designers to determine compliance with orbital debris mitigation requirements in NASA's Technical Standard, NASA-STD-8719.14A. The Debris Assessment Software, along with the Object

Reentry Survival Analysis Tool software, can be used to predict reentry survivability of an upper stage or spacecraft for human casualty risk assessments.

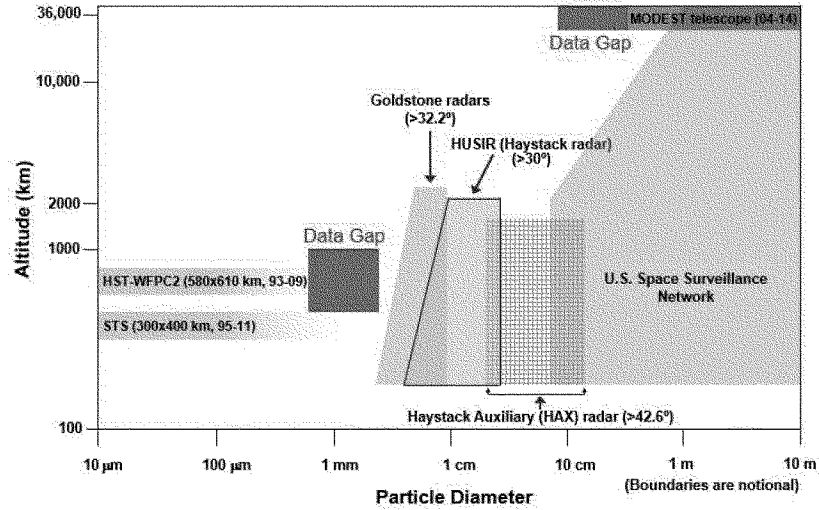
Another important ODPO tool used to understand the debris environment is the LEO-to-GEO Environment Debris (LEGEND) model. LEGEND is NASA's long-term debris evolutionary model designed to predict the environment 100-200 years into the future based on user-specified scenarios, such as future launch rates and different mitigation and remediation measures. It is often used to test the effectiveness of mitigation and remediation strategies in use by the U.S. and other spacefaring nations. It can also be used to investigate potential negative long-term effects from special classes of missions, such as the proposed large constellations, to the environment to support the development of new guidelines and best practices to mitigate such effects.

The inputs to these models are obtained by statistical measurements using ground-based radars and optical telescopes and by analysis of spacecraft surfaces that have been exposed to the space environment. None of these observations are primarily intended to provide real-time, actionable data like the collision-avoidance information from the 18 SPCS. Their goal is to monitor changes in the environment and to provide statistical data to update ODPO models, especially ORDEM, which is used to address the main orbital debris impact risks to space missions.

For radar, ODPO uses the Haystack and Haystack Auxiliary radars operated by MIT Lincoln Labs and NASA's Deep-Space Network Goldstone radars. These radars can make statistical observations of the small particle environment (in some cases objects as small as 2-3 mm) in LEO (the region below 2000 km altitude), but they are incapable of tracking individual small debris. Optical telescopes are primarily used to characterize the environment at higher altitudes, such as the geosynchronous orbit region (36,000 km altitude). ODPO, in collaboration with the Air Force, has developed and installed the Meter Class Autonomous Telescope (MCAT) on Ascension Island. MCAT is in the process of undergoing readiness reviews and testing prior to proceeding to full operation, and should be able to help characterize and monitor debris in the geosynchronous and other regions in early 2019. Note that in the future, because of its unique capabilities and location, the MCAT is expected to have the capability to aid the 18 SPCS with its cataloging and tracking function on an as-needed basis.

To improve our characterization and monitoring of the small particle (millimeter or smaller) environment, the ODPO has developed the Debris Resistive/Acoustic Grid Orbital NASA-Navy Sensor (DRAGONS). DRAGONS is a cooperative project among NASA's Orbital Debris Program Office, Naval Research Lab, and the U.S. Naval Academy. It is an *in situ* experiment designed to fly on a spacecraft host and be directly exposed to the space environment and detect debris impacts on its surface. It combines three sensor technologies, acoustic sensor, resistive grid, and dual-layer thin films to characterize the size, impact speed, impact direction, and the energy of the impacting particle. NASA has recently funded a technology demonstration mission of the sensor on the International Space Station to mature the DRAGONS technologies.

Below is an orbital debris measurement coverage chart, from LEO to GEO. MCAT, which is used by NASA as a tool for debris characterization and modeling/analysis, will address the gap in GEO (for debris down to ~15-20 cm in size). *In situ* measurements are needed to fill the millimeter sized debris gap at 600-1000 km altitude in LEO since debris in that size regime represent the highest mission-ending risk to spacecraft operating in that region. Data on such small debris could help improve the orbital debris impact risk assessments for the current missions and support the development and implementation of cost-effective debris impact protective measures for the safe operations of future missions.



To better understand the outcome of on-orbit collisions and to provide calibration data for radar and optical debris measurements, NASA and the Air Force Space and Missile Systems Center (SMC) have collaborated on a laboratory satellite impact test called DebrisSat. A representative modern satellite was designed, fabricated, and then subjected to the impact of a ~10 cm projectile at close to 7 km/sec impact speed at the Air Force's Arnold Engineering Development Complex. The DebrisSat fragment data will be used to improve the NASA and Air Force's satellite breakup models and be used to support other SSA applications, such as improving the debris size estimation model for radar observations and developing an optical debris size estimation model for telescope observations.

Almost all of ODPO's measurements projects are collaborations with DoD and some also have university involvement. There is a MOU between DoD and NASA for measurements from the Haystack radars. The ODPO is also collaborating with the DoD on calibration of the new Space Fence.

The ODPO is recognized worldwide as the leader in orbital debris measurements, modeling, and policy development. The NASA ODPO is located at Johnson Space Center and is funded by NASA Office of Safety and Mission Assurance at Headquarters. The current funding line for the ODPO is approximately \$7 million/year.

Conclusion

NASA looks forward to continuing to collaborate with our interagency partners to ensure a safe and sustainable orbital environment. As a leading user of space situational awareness data, the world's leading organization for characterizing the orbital debris environment, and the world's leading space exploration agency, NASA is a major beneficiary of the Administration's continuing attention to these issues.

Mr. Chairman, I would be happy to respond to any questions you or the other Members of the Subcommittees may have.

NASA Administrator Jim Bridenstine

James Frederick “Jim” Bridenstine was nominated by President Donald Trump, confirmed by the U.S. Senate, and sworn in as NASA’s 13th administrator on April 23, 2018.

Bridenstine was elected in 2012 to represent Oklahoma’s First Congressional District in the U.S. House of Representatives, where he served on the Armed Services Committee and the Science, Space and Technology Committee.

Bridenstine’s career in federal service began in the U.S. Navy, flying the E-2C Hawkeye off the USS Abraham Lincoln aircraft carrier. It was there that he flew combat missions in Iraq and Afghanistan and accrued most of his 1,900 flight hours and 333 carrier-arrested landings. He later moved to the F-18 Hornet and flew at the Naval Strike and Air Warfare Center, the parent command to TOPGUN.

After transitioning from active duty to the U.S. Navy Reserve, Bridenstine returned to Tulsa, Oklahoma, to be the Executive Director of the Tulsa Air and Space Museum & Planetarium.

Bridenstine was promoted to the rank of Lieutenant Commander in 2012 while flying missions in Central and South America in support of America’s war on drugs. Most recently, he transitioned to the 137th Special Operations Wing of the Oklahoma Air National Guard.

Bridenstine completed a triple major at Rice University, and earned his MBA at Cornell University. He has three children with his wife, Michelle.

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Statement of

**Wilbur Ross
Secretary
Department of Commerce**

before the

**Subcommittee on Strategic Forces
Committee on Armed Services
U. S. House of Representatives**

and

**Subcommittee on Space
Committee on Science, Space and Technology
U. S. House of Representatives**

Good morning, and thank you to Chairman Rogers, Chairman Babin, Ranking Member Cooper, and Ranking Member Bera for providing an opportunity for me to address you today. I would also like to thank Chairman Smith, Chairman Thornberry, as well as Ranking Members Johnson and Smith, for their work on this important issue. Your continued support of this Administration's space policy vision and support of the Department of Commerce are greatly appreciated. In addition, thank you to my esteemed colleagues General Hyten and Administrator Bridenstine for joining me on this panel. It is a pleasure to be here with all of you – decision makers, leaders, and enablers of U.S. space commercial and defense policy. Your work is imperative to the future achievement and well-being of the United States.

This has been an eventful week. The National Space Council met on Monday for the third time since President Trump reestablished it nearly a year ago to advise and assist him regarding national space policy and strategy. Under the leadership of Vice President Pence, the National Space Council has been very busy, providing recommendations to the President that have already resulted in three presidential space directives. Space Policy Directive-1, signed on December 11, 2017, calls for human expansion across the solar system starting with the return of manned landings on the moon as a first step to reaching Mars. Space Policy Directive-2, signed on May 24, sets out an ambitious schedule for streamlining regulations for commercial use of space. As I discussed in my remarks at the National Space Council meeting this past Monday, the Department of Commerce is committed to achieving all the objectives laid out in Space Policy Directive-2 ahead of schedule.

President Trump continues to show his commitment to creating more opportunities for the space community to develop and thrive. He demonstrated that commitment at the National Space Council meeting Monday when he signed Space Policy Directive-3, debuting the country's first comprehensive National Space Traffic Management Policy. This new policy directs the Department of Commerce to provide a basic level of space situational awareness (SSA) data for public and non-public use, based on the space catalog compiled by the Department of Defense (DoD). Currently, the SSA catalog of all space objects orbiting Earth, some as small as 10 cm, is based on data from the DoD's Space Surveillance Network (SSN) and contributing sensors, and is maintained by the 18th Space Control Squadron, a Joint Force Space Component Command unit under United States Strategic Command.

Space Policy Directive-3 and the implementation plan approved by the National Space Council name Commerce as the new U.S. Government interface for space traffic coordination. This change will better enable DoD to focus on its national security mission. There is an increasing demand for DoD to focus on protecting and defending U.S. space assets and interests, with a parallel increase in the need for a dedicated entity to provide basic SSA data and space traffic management (STM) services to a rapidly growing commercial space industry. Commerce is ready to provide those services to industry to facilitate continued commercial development in outer space.

The need for timely and actionable SSA data and STM services has never been greater. As the U.S. commercial space industry makes plans to launch over 15,000 satellites during the next five years, those expensive assets will face a potentially dangerous orbital environment. The DoD currently observes well over 20,000 objects circling the Earth, many of which are softball-sized or larger pieces of man-made space debris, some flying around the Earth at speeds of up to 17,500 miles per hour. Even more concerning, there are an estimated 600,000 smaller objects that could still cause significant harm if a collision occurred. The impact of such a collision could cause a devastating chain reaction, and create even more dangerous debris in orbit. A large percentage of currently observed space debris resulted from only two major collisions in space. Effective space traffic coordination and orbital debris mitigation standards will help protect our Earth's orbits from further congestion.

For those reasons, President Trump and the National Space Council agree that the Department of Commerce should be the civil agency interface for the publicly releasable portion of the DoD catalog. With this role, Commerce can incentivize innovative space services based on an open architecture data repository. This repository will establish a mechanism for SSA data sharing that will enable enhanced STM services, to include industry-provided data and services.

Involvement by industry and others, such as academia, is paramount to the success of this endeavor. Both mature and emerging space companies, as well as universities, have input and experience that can help shape the development of this data repository and accompanying space traffic coordination best practices. As the number of actors in space grows, the need to refine satellite safety design guidelines and establish best practices necessitates close collaboration. Updated guidelines and standards will enable more efficient and effective industry compliance, and could help establish standards that can be proposed for adoption internationally. Commerce

is committed to facilitating these discussions and implementing their results so that the United States can provide global leadership for space traffic standards.

Commerce will lead this new responsibility in its Space Policy Advancing Commercial Enterprise (SPACE) Administration, a new office being established in the Office of the Secretary. The office will also house the Office of Space Commerce and the Commercial Remote Sensing Regulatory Affairs office, which already engage the space industry in promotional and regulatory roles respectively. The SPACE Administration will also coordinate the involvement of Commerce's other space equities throughout the Department, including the National Telecommunications and Information Administration, which manages federal spectrum use for space communications; the National Institute of Standards and Technology, which has a proven track record of working with industry to conduct research and define essential scientific standards; and the National Oceanic and Atmospheric Administration, which already oversees the country's largest operational civil satellite fleet and engages in the space domain as the world's authoritative resource for timely and accurate space weather monitoring.

Throughout its various space equities, Commerce is committed to streamlining processes and reducing regulatory burdens that could inhibit commercial sector growth and innovation. Consistent with its deadlines in Space Policy Directive-2, this week Commerce staff published an Advanced Notice of Proposed Rulemaking. This notice provides an opportunity for space companies and partners to comment on current remote sensing regulations to facilitate the publication of a revised rule this fall. These reforms and our new space traffic coordination responsibility will be essential for opening up outer space for more commercial activity.

This is an important task and we have dedicated serious deliberation and planning in its execution. We have an excellent working relationship with our partners in DoD and look forward to continuing to work with them to carry out the implementation plan approved by the National Space Council. We are setting clear milestones and want to be transparent about achieving them. Further, we want the Congress and stakeholders to recognize that we are taking the lessons of our interagency counterparts to heart, and that the Department of Commerce appreciates how important it is to get this right.

Commerce is first and foremost dedicated to creating economic growth and sustainable development in all industry sectors. Facilitating space traffic coordination will provide the space industry with more tools to be successful. As such, with this new responsibility Commerce will work with industry to find ways to enhance space traffic coordination data and be adaptive to industry concerns. We want to evolve the architecture that currently supports U.S. Strategic Command to be even more responsive to the space industry's needs, and welcome your feedback and suggestions.

With Commerce at the helm of commercial space traffic coordination, we will ensure that the growing space industry remains open for business. I would be happy to respond to any questions members of the Subcommittees may have.

Wilbur Ross, Secretary of Commerce

Wilbur L. Ross, Jr. was sworn in by Vice President Mike Pence as the 39th Secretary of Commerce on February 28, 2017. Secretary Ross is the principal voice of business in the Trump Administration, ensuring that U.S. entrepreneurs and businesses have the tools they need to create jobs and economic opportunity.

Secretary Ross is the former Chairman and Chief Strategy Officer of WL Ross & Co. LLC and has over 55 years of investment banking and private equity experience. He has restructured over \$400 billion of assets in the airline, apparel, auto parts, banking, beverage, chemical, credit card, electric utility, food service, furniture, gypsum, homebuilding, insurance, marine transport, mortgage origination and servicing, oil and gas, railcar manufacturing and leasing, real estate, restaurant, shipyard, steel, textile and trucking industries. Secretary Ross has been chairman or lead director of more than 100 companies operating in more than 20 different countries.

Named by Bloomberg Markets as one of the 50 most influential people in global finance, Secretary Ross is the only person elected to both the Private Equity Hall of Fame and the Turnaround Management Hall of Fame. He previously served as privatization adviser to New York City Mayor Rudy Giuliani and was appointed by President Bill Clinton to the board of the U.S.-Russia Investment Fund. President Kim Dae-jung awarded Secretary Ross a medal for helping South Korea during its financial crisis and, in November 2014, the Emperor of Japan awarded him the Order of the Rising Sun, Gold and Silver Star.

As a philanthropist, Secretary Ross has served as Chairman of the Japan Society, Trustee of the Brookings Institution and Chairman of its Economic Studies Council, International Counsel Member of the Musée des Arts Décoratifs in Paris, Trustee of the Blenheim Foundation, President of the American Friends of the Rene Magritte Museum in Brussels and Director of the Palm Beach Civic Association. He also was an Advisory Board Member of Yale University School of Management.

Secretary Ross is a graduate of Yale University and Harvard Business School (with distinction). He and his wife Hilary Geary Ross have four children, Jessica Ross, Amanda Ross, Ted Geary and Jack Geary.

QUESTIONS SUBMITTED BY MEMBERS POST HEARING

JUNE 22, 2018

QUESTIONS SUBMITTED BY MR. COFFMAN

Mr. COFFMAN. Regarding the transition of civil oriented Space Situational Awareness (SSA) services from USSTRATCOM to the Department of Commerce (DOC), as suggested in the House Science Committee's legislation a. How will the handoff occur and what is the estimated timeframe for such a transition? What criteria will be used to determine that the civil DOC SSA system is ready for operations? b. Will the current USSTRATCOM SSA system be available as a backup to the civil DOC SSA system, and vice versa? Will USSTRATCOM space object tracking sensors, including the Space Fence, be used by the civil DOC SSA system? If so, how will the military sensors be integrated with the DOC? c. How will all global satellite owner/operators be incentivized to participate in the civil DOC SSA and Space Traffic Coordination (STC) programs?

General HYTEN. Although a timeframe and detailed specifics of transitioning inherently non-military space traffic management functions to the DOC are still being finalized, USSTRATCOM has fully partnered with the DOC, to ensure a smooth, efficient and most importantly, safe hand-off. By year-end, both Departments will jointly provide a progress report to the National Space Council detailing requirements for a successful transition . . . to include a timeline for transition, a construct for managing the provision of basic SSA data; assessing the statutory and regulatory changes required; and maintaining the US space catalog while making portions releasable (via DOC) to the public.

b. USSTRATCOM will continue to maintain the authoritative US space catalog and to provide military-unique SSA services upon DOC developing its indigenous STM capabilities. As part of this effort, we will investigate providing backup capabilities for DOC. The DOC will make publically available portions of the authoritative catalog which DOD will continue to maintain. We expect a variety of DOD, civil, Allied, and commercial sensors will contribute data which will be used to form DOC's publically releasable catalog.

c. We anticipate global satellite owner/operators wanting to leverage DOC capabilities out of their own best interest just as they use the USSTRATCOM capabilities today. This information will preserve their ability to utilize the space domain while minimizing the risk from orbital debris.

Mr. COFFMAN. We have very important assets in my district that contribute to the Space Situational Awareness mission, and it is clear that DOD's SSA requirements will be increasing in the future given our space control plans. How will the administration's new Space Traffic Management Policy help you better prioritize DOD resources to meet DOD requirements?

General HYTEN. While many details concerning the increased Department of Commerce role in SSA remain under development, by moving any inherently non-military activities to a civil agency I will be able to re-prioritize my resources to focus on meeting DOD requirements. These include:

- Strengthen intelligence collection, analysis, and sharing to effectively assess potential adversary space, counterspace capabilities vulnerabilities and intentions
- Acquire enhanced SSA capabilities and leverage commercial and allied/partner capabilities to provide Indications & Warning (I & W) of objects in space
- Achieve full operational capability of the National Space Defense Center and continue development of infrastructure to allow command and control of space warfighting capabilities
- Pivot SSA capabilities from routine catalog maintenance to more dynamic, search-based situational awareness with increased focus on potential hostile activity. This will enhance our ability to Protect and Defend the space domain and provide space effects for warfighters around the world
- Deter, and—when necessary—defeat adversary space and counterspace threats.

Mr. COFFMAN. Given that the DOD has already negotiated more than 60 different agreements with commercial and international entities, what is your plan to smoothly transfer those contracts to the Department of Commerce to minimize service disruption? Do you believe that you will need to maintain mil-to-mil agreements for SSA, how are you thinking about that framework of international military cooperation in the SSA realm for the future? a. What is your assessment today of the Department of Commerce's ability to manage these authorities? Do they have the proper resources and personnel and what is your opinion on what is needed to get them there? b. What are the implications of an immediate move of these situational space awareness (SSA) authorities from DOD to the Department of Commerce? Are you concerned that hiccups in a transition may damage the United States position as the lead provider of global SSA?

General HYTEN. As of 21 Sep 18, USSTRATCOM has 88 agreements with governments, commercial satellite owner operations, and service providers. For military-to-military agreements, USSTRATCOM will continue to have a significant role, however, many SSA sharing agreements are not inherently military. Consequently, USSTRATCOM is working closely with the Department of Commerce (DOC) to ensure an efficient and smooth transition of these non-military U.S. agreements with civil and commercial spacefarers. Though many details remain under development, a future where the DOC is responsible for negotiating, concluding, and executing SSA sharing agreements with commercial entities is indeed achievable. While DOC grows its capabilities, USSTRATCOM is fully committed to supporting our commercial, civil and international partners. We have no intention of transferring these responsibilities before DOC is prepared to take them on. I am not concerned about the transition because I have faith in the men and women executing this mission.

Mr. COFFMAN. Are you concerned this new need for space funding will cannibalize from NASA budgets?

Mr. BRIDENSTINE. Space Policy Directive-3 (SPD-3), National Space Traffic Management Policy, recognizes that after more than 60 years of human space activities, orbital debris has become a serious problem to space operations. SPD-3 highlighted the need to advance space situational awareness and improve the fundamental knowledge of the space environment, such as the characterization of small debris. NASA will continue to prioritize requirements within available budget constraints, while striving to achieve SPD-3 objectives.

Mr. COFFMAN. Regarding the transition of civil oriented Space Situational Awareness (SSA) services from USSTRATCOM to the Department of Commerce (DOC), as suggested in the House Science Committee's legislation, a. How will the handoff occur and what is the estimated timeframe for such a transition? What criteria will be used to determine that the civil DOC SSA system is ready for operations? b. Will the current USSTRATCOM SSA system be available as a backup to the civil DOC SSA system, and vice versa? Will USSTRATCOM space object tracking sensors, including the Space Fence, be used by the civil DOC SSA system? If so, how will the military sensors be integrated with the DOC? c. How will all global satellite owner/operators be incentivized to participate in the civil DOC SSA and Space Traffic Coordination (STC) programs?

Secretary ROSS. [The information was not available at the time of printing.]

Mr. COFFMAN. Given that the DOD has already negotiated more than 60 different agreements with commercial and international entities, what is your plan to smoothly transfer those contracts to the Department of Commerce to minimize service disruption? Do you believe that you will need to maintain mil-to-mil agreements for SSA, how are you thinking about that framework of international military cooperation in the SSA realm for the future? a. What is your assessment today of the Department of Commerce's ability to manage these authorities? Do they have the proper resources and personnel and what is your opinion on what is needed to get them there? b. What are the implications of an immediate move of these situational space awareness (SSA) authorities from DOD to the Department of Commerce? Are you concerned that hiccups in a transition may damage the United States position as the lead provider of global SSA?

Secretary ROSS. [The information was not available at the time of printing.]

Mr. COFFMAN. How much will this new program cost in year one, and how will these costs grow in the out-years?

Secretary ROSS. [The information was not available at the time of printing.]

QUESTIONS SUBMITTED BY MR. HUNTER

Mr. HUNTER. The 2013 National Space Transportation Policy calls for the use of U.S. rockets for U.S. government payloads, with some minor exceptions that perhaps should be revisited anyway. President Trump's Space Policy Directive-2 directs the executive branch to "encourage American leadership in space" and "promote economic growth." The U.S. currently has a competitive space launch industry, yet NASA payloads continue to fly on foreign launch vehicles, even those that are subsidized by foreign governments. Could NASA better promote the goals of the National Space Transportation Policy and Space Policy Directive 2 by using American rockets to launch American satellites? Should we have a "Buy American, Fly American" policy?

General Hyten, as DOD looks to purchase more commercial data and services, do you agree that these should be purchased from entities that launch from American spaceports?

General HYTEN. The U.S. operates in a unique and contested space domain where all opportunities must be utilized. This includes leveraging our partner nations, if necessary, to increase responsiveness and capabilities. While I firmly believe the nation should maintain the ability to launch a vast majority of its payloads, such restrictions may limit the responsiveness and capabilities necessary to meet increasingly dynamic DOD requirements. The President's National Strategy for Space addresses this issue. It stipulates the National Space Council develop a plan to remove barriers, streamline regulations, and reduce bureaucratic hurdles to commercial space companies, taking into account national security/public safety. Furthermore, the strategy directs Departments and Agencies to "promote conditions that result in a thriving and competitive domestic space industry" and "ensure the health of the industrial base to support required activities while protecting critical U.S. technologies and capabilities."

Mr. HUNTER. Administrator Bridenstine, the 2013 National Space Transportation Policy calls for the use of U.S. rockets for U.S. government payloads, with some minor exceptions that perhaps should be revisited anyway. President Trump's Space Policy Directive-2 directs the executive branch to "encourage American leadership in space" and "promote economic growth." The U.S. currently has a competitive space launch industry, yet NASA payloads continue to fly on foreign launch vehicles, even those that are subsidized by foreign governments. Could NASA better promote the goals of the National Space Transportation Policy and Space Policy Directive-2 by using American rockets to launch American satellites? Should we have a "Buy American, Fly American" policy?

Mr. BRIDENSTINE. NASA believes existing statute and policy supports a "Buy American Fly American" objective. NASA complies with 51 USC 50131, the 2013 National Space Transportation Policy, and Space Policy Directive-2 for the launch services it procures and uses in support of Agency payload missions, with regard to both the launch vehicle and the provider of the launch service. 51 USC § 50131 requires the U.S. Government to procure space transportation services from domestic commercial providers, with a few specific exceptions. The National Space Policy also requires the U.S. Government to use U.S. commercial space transportation services. NASA procures launch services in accordance with existing law and policy. In addition, NASA does not buy foreign launch vehicles for the launch of its satellites or science missions. United States Government payloads are to be launched on space launch vehicles manufactured in the United States, unless exempted by the Director of the Office of Science and Technology Policy and the Assistant to the President for National Security Affairs through an interagency process. This policy, however, does not apply to use of foreign launch vehicles on a no-exchange-of-funds basis to support the following: flight of scientific instruments on foreign spacecraft, international scientific programs, or other cooperative government-to-government programs. A primary example of the application of this exception is the James Webb Space Telescope (JWST), for which the European Space Agency (ESA) has agreed to provide an Ariane 5 launcher and associated launch services to NASA as part of the European contribution to the mission.

QUESTIONS SUBMITTED BY MR. MITCHELL

Mr. MITCHELL. Administrator Bridenstine, you testified that the Federal Aviation Administration (FAA) has already been involved in discussions about Space Situational Awareness (SSA) and Space Traffic Management (STM). Can you detail how the National Aeronautical and Space Administration has worked with the Department of Transportation and the FAA previously—both during your tenure and before?

Mr. BRIDENSTINE. The FAA has held informal discussions with NASA, among other space operators, about the Agency's internal methods for conjunction assessment risk analysis for both robotic and human spacecraft. However, these information exchanges were all informal; there is no formal agreement between NASA and the FAA focused on SSA or STM activities.

Mr. MITCHELL. You testified that you support the Department of Commerce leading this mission as Space Policy Directive-3 calls for, but you also acknowledged that the FAA has special expertise in managing air traffic already. How does your agency intend to work with the FAA on SSA and STM moving forward?

Mr. BRIDENSTINE. Under the auspices of SPD-3, NASA is leading an interagency effort to update the U.S. Government Orbital Debris Mitigation Standard Practices so that that regulatory agencies—Departments of Transportation and Commerce or the Federal Communications Commission—have a sound scientific and technical basis for developing orbital debris mitigation policies and regulations for their re-

spective commercial licensing regimes. NASA also has expertise in conjunction assessment risk analysis within our human and robotic space missions and will provide inputs relative to best practices to help inform DOT and DOC efforts.

Mr. MITCHELL. General Hyten testified that when it comes to space, every element of the government is involved and that means there are going to be seams. He said that the seams are best addressed by establishing clear authorities and responsibilities. Can you provide more detail on how authorities and responsibilities are going to be handled among the partners identified in Space Policy Directive-3, especially the Department of Transportation?

Mr. BRIDENSTINE. NASA would respectfully defer to the SPD-3, the first National Space Traffic Management Policy for a detailed and comprehensive outline of roles and responsibilities within the interagency, both currently and in future, as the Department of Defense transitions some roles to the Department of Commerce. The Department of Transportation will retain its current role of regulation of commercial launch, landing and spaceports.

Mr. MITCHELL. Both space and traditional commercial airspace traffic have some interplay, how are you resolving that issue? How are you working with FAA to address that specific seam?

Mr. BRIDENSTINE. Launch and landing are where spaceflight interfaces with the U.S. National Airspace and its air traffic. NASA is a partner in a four-agency coordination group (Air Force Space Command, National Reconnaissance Office, FAA, NASA) that consider, among other launch and landing topics, how to address joint use between the launch ranges and the National Airspace as the number of commercial launch ranges and the frequency of commercial space launches is expected to increase.

Mr. MITCHELL. How does NASA envision Space Situational Awareness and Space Traffic Management playing out in practice? Will this be handled by a government agency or is this an authority that could be given to another type of non-governmental entity?

Mr. BRIDENSTINE. The SPD-3 outlines a thoughtful and practical approach for implementing an improved future construct for Space Traffic Management, including Space Situational Awareness. SPD-3 does not limit involvement in STM and SSA activities and products to government agencies. As with any proposed approach, NASA and the rest of the interagency will make adjustments along the way as appropriate and as circumstances warrant.

Mr. MITCHELL. Administrator Bridenstine testified that the Federal Aviation Administration (FAA) has already been involved in discussions about Space Situational Awareness (SSA) and Space Traffic Management (STM). Can you detail how the Department of Commerce has worked with the Department of Transportation and the FAA—both during your tenure and before?

Secretary ROSS. [The information was not available at the time of printing.]

Mr. MITCHELL. Space Policy Directive-3 makes the Department of Commerce the lead agency for Space Situational Awareness and Space Traffic Management, but it also calls on them to cooperate with other agencies. The Federal Aviation Administration at the Department of Transportation already has unique expertise in commercial airspace management. How does the Department of Commerce plan to work with them on this issue moving forward?

Secretary ROSS. [The information was not available at the time of printing.]

Mr. MITCHELL. General Hyten testified that when it comes to space, every element of the government is involved and that means there are going to be seams. He said that the seams are best addressed by establishing clear authorities and responsibilities. Can you provide more detail on how authorities and responsibilities are going to be handled among your partners identified in Space Policy Directive-3, especially the Department of Transportation?

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Secretary ROSS. [The information was not available at the time of printing.]