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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2018 AND THE FUTURE YEARS DEFENSE PROGRAM

HEARINGS

BEFORE THE

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

ONE HUNDRED FIFTEENTH CONGRESS

FIRST SESSION

ON

S. 1519

TO AUTHORIZE APPROPRIATIONS FOR FISCAL YEAR 2018 FOR MILITARY ACTIVITIES OF THE DEPARTMENT OF DEFENSE, FOR MILITARY CONSTRUCTION, AND FOR DEFENSE ACTIVITIES OF THE DEPARTMENT OF ENERGY, TO PRESCRIBE MILITARY PERSONNEL STRENGTHS FOR SUCH FISCAL YEAR, AND FOR OTHER PURPOSES

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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2018 AND THE FUTURE YEARS DEFENSE PROGRAM

WEDNESDAY, MAY 17, 2017

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

MILITARY SPACE ORGANIZATION, POLICY, AND PROGRAMS

The subcommittee met, pursuant to notice, at 2:00 p.m. in Room SR–222, Russell Senate Office Building, Senator Deb Fischer (chairman of the subcommittee) presiding.

Present: Senators Fischer, Cotton, Sullivan, Cruz, Rounds, Donnelly, Heinrich, Warren, and Peters.

OPENING STATEMENT OF SENATOR DEB FISCHER

Senator FISCHER. Good afternoon and welcome. The hearing will come to order.

The committee meets today to receive testimony on space organization, policy, and programs. I would like to thank the very distinguished panel of witnesses for agreeing to testify before us today.

Space-based capabilities are integral to the way our military operates and our society functions. As previous hearings in this subcommittee have documented, our adversaries are developing increasingly sophisticated ways to attack U.S. space assets and exploit the domain for their own purposes.

General Hyten, General Raymond's predecessor and the current STRATCOM [Strategic Command] commander, told us just last month that space is a warfighting domain just like air, ground, maritime, and cyber, and we must normalize how we plan and operate in space.

This new environment requires a flexible and an innovative military space enterprise capable of overcoming an ever-changing threat picture and rapidly delivering capabilities to the warfighter. However, the work of numerous reviews and commissions suggests there is a deep gap between the space enterprise that we need and the one that we have.

For example, the Rumsfeld Commission concluded in 2001 that the Department of Defense is not yet arranged or focused to meet the national security space needs of the 21st Century. More re-

cently, a study by the GAO [Government Accountability Office] directed by this subcommittee in 2015 concluded that DOD [Department of Defense] space leadership responsibilities are fragmented and spread across approximately 60 stakeholder organizations from DOD to the Executive Office of the President to the intelligence community and civilian agencies. Eight of the 60 stakeholders have acquisition responsibilities, 11 are responsible for oversight, and 6 are involved in setting requirements for defense space programs.

I question whether such an arrangement can meet the Nation's needs in space, and I look forward to hearing our witnesses' views on how the current architecture can be improved.

As we examine the organizational structure of the space enterprise, it is equally important that we ensure it receives the necessary personnel and resources. A recent study by the Department of Defense Office of Cost Assessment and Program Evaluation, or CAPE, noted that funding for space procurement and research and development are both at or near 30-year lows.

Additionally, my colleague on the House Armed Services Committee, Congressman Rogers, has noted that out of the 37 nominees in March on the Air Force promotion list, from colonels to one-star generals, none of the nominees were career space professionals, like General Hyten, General Raymond, and Lieutenant General Greaves were at that point in their career. Both of these statements call into question whether the Department is appropriately prioritizing space.

Let me again thank the witnesses for their service and for testifying today.

I now recognize the ranking member, Senator Donnelly, for any opening remarks he would like to make.

Senator Donnelly?

STATEMENT OF SENATOR JOE DONNELLY

Senator DONNELLY. Thank you, Madam Chair.

I want to start by thanking all of our witnesses for being here today, and thanking you for calling this hearing on such an important subject.

Secretary Wilson and General Goldfein, your presence here today sends a powerful message on the importance of these issues to our national security. Thanks for joining us and for your leadership on defense space issues.

General Raymond, this is your first time before the committee, and I welcome and look forward to your input.

General Greaves, I understand that this will be your last appearance as director of the Space and Missile System Center. Let me thank you for your service and leadership. I know you will miss us immensely over here at the hearing rooms. You will soon lead the Missile Defense Agency, so we will be seeing more of you before the subcommittee.

Ms. Chaplain, as always, you and your team are critical to the work of the subcommittee. We rely heavily on you, and we are thankful for the advice you give us on space issues. It is critically important.

Today's hearing will focus on two issues. How can the Air Force and the Department improve the way we conduct space missions?

How can we acquire space systems rapidly to meet mission requirements?

Freedom of navigation in space cannot be taken for granted these days. Any conflict on the ground will quickly spread to space, and today's space systems are fragile.

Prior thinking on how we perform our space mission needs to change and quickly, as General Hyten noted. Our disconnected operations, acquisition efforts, and resourcing hamper us today both in Air Force and DOD as a whole. I hope we can change that sooner rather than later.

I look forward to your views today in helping this subcommittee address these pressing issues.

Thank you.

Senator FISCHER. Thank you, Senator Donnelly.

We will now turn to our witnesses for their opening statements, and your full remarks will be put into the record.

I would like to welcome Secretary Wilson. This is your first official hearing, and we appreciate you being here today. Welcome.

STATEMENT OF HONORABLE HEATHER A. WILSON, SECRETARY OF THE AIR FORCE, ACCOMPANIED BY GENERAL DAVID L. GOLDFEIN, USAF, CHIEF OF STAFF OF THE AIR FORCE; GENERAL JOHN W. RAYMOND, USAF, COMMANDER, AIR FORCE SPACE COMMAND; LIEUTENANT GENERAL SAMUEL A. GREAVES, USAF, COMMANDER, SPACE AND MISSILE SYSTEMS CENTER, AIR FORCE SPACE COMMAND

Secretary WILSON. Thank you, Madam Chairman, and thank you for putting our statement in the record. General Goldfein and I will highlight a few key points, and then we look forward to taking your questions.

It is obvious but it is probably worth repeating that the U.S. is heavily dependent upon space, and our adversaries know it, and they know it is a vulnerability. In any conflict, space will be contested.

We have not always assumed that in the past, and so there is really underway, and has been for some time now, certainly since 2007, a change in culture, a change in planning and training going on in the United States military because we cannot take space dominance for granted.

The second major thing is that since this is now less than 24 hours since I was sworn into office, but over the last week since the United States Senate voted on my confirmation, I have been rolling up my sleeves pretty seriously every day and getting reacquainted with the space programs, which I had not been read into since serving on the Intelligence Committee in the House.

While there is a lot more to do, I will tell you that I have been initially pleased by some of the things I see on what the Air Force is doing to improve training, to identify gaps, to experiment with new concepts of operations, particularly in the last 18 to 24 months. There is a great deal that is going on with respect to addressing the needs of the Nation to be able to prevail in space. I think you should know that from me, coming back into the national security business.

With respect to acquisition, we also have a lot of equipment and services that are going to be bought for space in the next few years. It is a very heavy agenda, a very heavy menu that we are going to have to go through.

I wanted to personally thank you for giving authority back to the Air Force for acquisition, because we do need to clean these things up. I think it is going to help, and we are working in the Department of Defense to implement the changes which you authorized, so we can get the capabilities that we need on time and on budget.

Those changes are not yet fully implemented, and it is one of the priorities with respect to organizing the mission in the Air Force and getting those things done.

Finally, timing is not exactly ideal for this hearing in the sense that the full budget rollout will be next week, but I expect an increase in space expenditure from fiscal year 2017, and what we cannot accommodate will, of course, appear on the unfunded priorities list.

One of the great things about being a new Secretary with an interest in space is that it is a team that gets things done. I am pleased to be here today with an exceptional team of leaders in space, and that starts out with an exceptional chief of staff, and I turn it over to General Goldfein.

Senator FISCHER. Thank you, Madam Secretary.

General?

STATEMENT OF GENERAL DAVID L. GOLDFEIN, USAF, CHIEF OF STAFF OF THE AIR FORCE

General GOLDFEIN. Thanks, Chairwoman Fischer and Ranking Member Donnelly. Thanks for holding this important and timely hearing.

I cannot tell you what an honor it is to sit here with Dr. Wilson, our 24th Secretary of the Air Force, 24 hours after she was sworn in. I will just tell you that she gives new meaning to one of my favorite quotes: The fight is on.

Along with General Raymond and Lieutenant General Greaves, we really appreciate you holding this hearing.

As the air component commander in Central Command some years ago, one of my assigned missions from the combatant commander, who at the time was General Jim Mattis, was to be his space coordinating authority.

It was my responsibility to first understand his space requirements and those of my fellow component commanders from the Navy, the Army, the Marines, the SOF [Special Operations Forces], the Coast Guard, and our interagency and allied partners across the region and to ensure their mission needs were being covered by capabilities provided by 14th Air Force and U.S. Strategic Command. It was a natural fit because I had the only headquarters in the region with the ability to coordinate space activity in support of combatant command and commander operations.

Today's air component commanders in all of our COCOMs [Combatant Command] are performing this space coordinating authority duty from their air and space operations centers. It is this experience employing space capabilities in combat that frames how I see

my responsibilities today first as a member of the Joint Chiefs and also as a Service Chief.

As a Joint Chief, I have a responsibility to work with the chairman, my fellow Joint Chiefs, and our interagency partners to understand their requirements and ensure they are appropriately represented in all space activities. As the Service Chief with responsibility for over 90 percent of the space enterprise, I have an obligation to work with Secretary Wilson to organize, train, equip, and present ready forces to the combatant commander, General John Hyten, so he can fight should a war either start or extend into space.

Space superiority, like air superiority, is not an American birthright. It requires vigilance and action. We have many more steps ahead of us, but America's airmen remain committed to evolving our space organization, strategy, requirements, architecture, and forces to adapt to the new reality that you laid out and ensure we gain and maintain air and space superiority.

As Secretary Wilson has stated, we have accomplished a great deal in the last few years. The Air Force has streamlined decision-making for the space enterprise. We are normalizing, integrating, and elevating space, building on over 60 years of space operations experience. However, there is much more work to be done, and we look forward to working with this committee and our interagency partners to strengthen our competitive advantage in this critical domain.

Our legacy includes Benny Schriever, the father of Air Force Space; Thomas White, our fourth Chief of Staff; Jerome O'Malley, the leader most responsible for Space Command; Tom Moorman; Kevin Chilton; Bob Kehler; Susan Helms; John Hyten—all space giants. This has been our business since 1954. We will own the high ground.

Thank you again for holding this hearing, and I look forward to your questions.

[The joint prepared statement of The Honorable Heather A. Wilson, General David L. Goldfein, General John W. Raymond, and Lieutenant General Samuel A. Greaves follows:]

JOINT PREPARED STATEMENT OF THE HONORABLE HEATHER A. WILSON, GENERAL DAVID L. GOLDFEIN, GENERAL JOHN W. RAYMOND, AND LIEUTENANT GENERAL SAMUEL A. GREAVES

INTRODUCTION

Chairwoman Fischer, Ranking Member Donnelly, and distinguished Members of the Strategic Forces Subcommittee, thank you for the opportunity to discuss the challenges America faces in space and how the United States Air Force (USAF) will meet those challenges.

SPACE WILL BE CONTESTED . . . IT IS NOW WARFIGHTING DOMAIN

For decades the United States has enjoyed unimpeded freedom of action in space. This benign environment allowed us to operate satellites for intelligence collection, missile warning, weather monitoring, communications, and precision positioning, navigation, and timing in support of all military operations for all of the services, without thinking about how to protect these systems. That environment no longer exists. Space will be contested in any conflict. Our potential adversaries understand the advantage we derive from space and view our reliance on space as a vulnerability they can exploit. Near-peer competitors will offset any U.S. military advan-

tage derived from our space systems and continue to pursue capabilities to degrade or destroy them.

Clearly, freedom to operate in space is not guaranteed. In fact, space is now a warfighting domain, similar to the more familiar air, land, and maritime domains our men and women are fighting in today. We must ensure the reliability of our current systems and we must modernize. Our modernization will focus on our ability to deter potential adversaries, and to fight in a contested, degraded, and operationally limited environment should deterrence fail.

SPACE SUPERIORITY

Maintaining Space Superiority (freedom from attack and the freedom to maneuver and attack) is a core USAF mission. It is not just operationally important, it is also a strategic imperative for protecting U.S. and allied capabilities throughout a crisis or conflict.

The Air Force is the lead service for space. Our space systems, including our ground elements, could be the first system attacked in a high-end fight. We are committed to gaining a full understanding of space operations in a contested environment. We have dedicated time and resources to ensure our satellites have the proper mission assurance in order to survive and be available for any operational mission conducted by the Department of Defense or the Intelligence Community. Our adversaries understand that orbits can be changed, sensors can be blinded, and data can be corrupted. Space systems allow U.S. global operations to be executed with precision on a daily, worldwide basis, with reduced resources for our joint partners, allowing them to deploy fewer troops, lower casualties on the battle front, and decrease collateral damage. Space Superiority empowers both our forces and those of our allies to win faster.

U.S. GOVERNMENT ACCOUNTABILITY OFFICE (GAO) 2016 REPORT

In July of 2016, the U.S. GAO released a report, "*DEFENSE SPACE ACQUISITIONS: Too Early to Determine If Recent Changes Will Resolve Persistent Fragmentation in Management and Oversight*" (GAO Code 100289). In response, the Fiscal Year 2017 National Defense Authorization Act (FY17 NDAA) directed the Secretary of Defense and the Office of Management and Budget to provide recommendations by June 23, 2017 on how to strengthen space organization and management.

To accomplish this, the Department of Defense (DOD) initiated a review of governance, strategy, budgeting, organization, concepts of operation (CONOPS) and acquisitions for space. The results of Air Force efforts thus far, as well as DOD-wide governance recommendations, will be reported to Congress later this summer.

USAF ORGANIZATION, POLICY, AND STRATEGY

1. Sharpen Warfighting Strategy and Policy Development.

The space enterprise is no longer simply an "enabler and force enhancer" . . . it is an *essential military capability* and a key component of joint warfare. When coupled with the rapidity and seriousness of the threat, we're faced with gaps in U.S. space capabilities, as well as gaps in strategy and space policy.

While the Air Force has made progress on mission assurance and resilient capabilities in operations, current policy does not fully address deterrence and requirements for action in the 21st Century. The DOD must also continue to develop a 21st Century deterrence strategy which clearly addresses the recklessness of a war extending to space, while ensuring our space enterprise is postured to successfully fight and win, should deterrence fail. Space strategy and policy must be agile, able to establish and foster a joint, combined, and multi-domain warfighting construct, and adapt to meet Combatant Commander integrated priorities.

The Air Force must be able to pursue, adapt, and evolve strategy and policy to ensure unique technologies, innovative exploitation techniques, and diverse applications afford a strategic advantage in space. The proper authorities must be appropriately placed in the hands of space enterprise commanders and officials. Those authorities must be pushed as far down as possible to ensure timely execution aligned with commander's intent. In the face of continuously adapting adversaries, evolving threats, and increased requirements for operational agility, space strategy and policy must guide decisive action to preserve the operational environment, and promote the responsible and safe use of space.

2. Strengthen CONOPS and Requirements Development.

Space is no longer a sanctuary. Most on-orbit capabilities are now vulnerable to our most challenging potential adversaries. The Air Force must prepare to survive

and fight in space so that other joint forces can deploy and achieve their objectives within a complex and dynamic battlespace.

A contested space domain is a relatively new and dynamic problem set, and the USAF is updating its warfighting construct for the space joint warfighting domain to ensure freedom of action, and freedom from attack, against the spectrum of threats that range from near-peer adversaries to individual actors. The space mission force, who operate space systems 24/7/365, are training with a warfighting mindset to effectively "fight" against threats to their systems in a conflict that extends to space. This enhanced space warfighting syllabus strengthens CONOPs that define how the space enterprise will operate through all phases of conflict. It also identifies and prioritizes needs and capabilities required by joint commanders,

While there are obvious differences due to the physics of the domain, space warfighting is consistent with operations in the air—for which the Air Force has well-developed command and control and operational doctrine. Like other warfighting domains, space effects span the globe and require centralized control and decentralized execution. Thwarting the enemy's objectives is best accomplished if actions are taken well in advance of the end-game, elevating the need for integrated courses of action in all domains. Accordingly, the Air Force is moving towards a Multi-Domain Command and Control approach that accelerates decision-making across all warfighting domains in ways that will overwhelm the adversary.

The DOD, in concert with the joint community, is also strengthening concepts of operation by developing Joint Counter-Space doctrine and publishing guidance in Joint Publications, such as Joint Pub 3–14 *Space Operations.* In addition, these CONOPS will drive future systems requirements. The Joint Staff has agreed with the Air Force's proposal to improve development of joint space requirements by adding full time USAF manpower to the Joint Staff dedicated to developing joint space requirements in coordination with U.S. Strategic Command (USSTRATCOM) and Air Force Space Command (AFSPC). The Space Requirements Integration Initiative (SRII), under the Joint Staff Deputy Director of Requirements (JS/DDR), will provide early insight into Air Force space requirements development and Air Force and Joint staffing processes. The effort will achieve Initial Operating Capability this month. In doing so, the joint space community will assist in developing and streamlining space requirements and reduce overall management time. This will ensure the DOD is able to: coordinate and integrate all space-related capability requirements; ensure requirements are identified and documented properly and to avoid the "re-litigation" of previously validated requirements; and institute the interactions with other portfolio management processes, such as the Capability Gap Assessment, Program and Budget Review, and Capability Portfolio Management Review.

3. Accelerate Acquisition to Stay Ahead of Adversaries.

In order to align space acquisition authorities with Department roles and responsibilities, the Air Force is, first and foremost, taking action to regain Milestone Decision Authority (MDA) on multiple major space acquisition programs. These actions include the February 27, 2017 MDA reversion request and the MDA delegation requests to the Office of the Secretary of Defense. The intent is to implement and comply with section 825 of the Fiscal Year 2016 National Defense Authorization Act (FY16 NDAA).

Most authorities essential to space acquisition improvement and success exist today, and the Air Force need only use these authorities to streamline current acquisition execution. For instance, the rapid acquisition authorities granted to the Operationally Responsive Space (ORS) program and the Air Force Rapid Capabilities Office (AFRCO) already allow execution of rapid prototyping and fielding of residual operational capability. Those authorities are supported by DOD instructions and overarching acquisition regulations that provide clear direction on alternative acquisition models, tailoring, and how to leverage rapid acquisition approaches. The USAF will exercise these authorities to the fullest extent possible, create strategies that remove potential obstacles and adapt current practices, while crafting new and improved approaches within these authorities. We must take immediate action to change the culture in our acquisition organizations to focus on speed, innovation, and risk acceptance.

4. Strengthen Joint Warfighting Organizations.

Today, every joint operation is enhanced with the integration of space capabilities. To succeed in the maritime, ground, and air domains to the degree warfighters have become accustomed, the DOD must be able to leverage the space domain similarly, which means effectively protecting and defending space capabilities for the joint fight. While current and potential enemies continue to develop space capabilities of

their own, as well as systems to attack, degrade, and defeat allied space systems, the DOD must ensure our space systems and space forces are prepared to preserve the enormous investment in the space domain. Therefore, the DOD must begin shifting its organizational and training structures to normalize warfighting concepts for the space domain.

In alignment with Congressional direction to have a senior space coordination official, in accordance with H.R. 1745, section 1602, the Secretary of Defense designated the Secretary of the Air Force to serve as Principal DOD Space Advisor (PDSA). The PDSA provides oversight of policy, resources, personnel and acquisitions and technology related to the DOD space enterprise. The PDSA also integrates the space control expertise and perspectives of appropriate organizational entities of the Office of the Secretary of Defense, the Joint Staff, the military Departments, the Defense Agencies, and the Combatant Commands. The PDSA is also responsible for recommendations to the Secretary of Defense and Deputy Secretary of Defense to monitor and oversee the performance of the entire DOD space portfolio and provides cogent and analytically supported programmatic recommendations to DOD leadership. Finally, the PDSA advises on space issues including policy and strategy formulation, international engagement, industrial base support and commercial partnerships. The PDSA construct is under review as part of the DOD response to the fiscal year 2017 NDAA language on space governance. To better mitigate the threat to our space enterprise, the USAF is evolving the processes used to program, budget, develop, acquire, and field space systems in order to organize, train, and equip our forces to be successful in a contested domain, defend systems from adversary action, and to ensure space missions throughout the spectrum of conflict.

Another key aspect of this normalization of the space domain is the requirement to institutionalize the mechanisms for training and equipping a combat capable force. USAF best practices learned from operating in the air domain can serve as a basis for developing corresponding mechanisms for addressing threats in space. These include understanding the capabilities, limitations, and vulnerabilities of effective weapon systems, operational testing and tactics development for those systems, basic qualification training, and advanced training for space crews. The, Space Mission Force (SMF) construct, recently implemented by AFSPC, affords space operators the opportunity to receive advanced training. It establishes a deployment period for space crews to perform Combatant Command missions, followed by a reconstitution period to focus on advanced training requirements.

Expert training must be conducted at the unit level and also at the aggregate space domain level to ensure the force is prepared to fight their weapon systems in a threat environment. To date, by design, space operators have been trained primarily in the basic operation of space systems for the purpose of delivering space effects to warfighters from a benign space environment. As a result, AFSPC has begun focusing on the threats in order to develop better understanding of how an adversary will operate to employ those capabilities. Leveraging the best practices of the air domain, space training must evolve to include robust development of tactics, techniques, and procedures (TTPs) for overcoming space threats, and include the entire joint team. The development of these TTPs will require the fielding of an Operational Training Infrastructure (OTI) for space systems.

HQ USAF DEPUTY CHIEF OF STAFF, SPACE OPERATIONS (AF/A11) & AFSPC

The Air Force Chief of Staff is the Joint Chief responsible for presenting space capabilities for the Joint Force and maintaining control of operational requirements. A key initiative in our efforts to strengthen our space organization is the stand up of a 3-star Deputy Chief of Staff for Space Operations position (AF/A11), who is directly accountable to the Secretary and Chief of Staff of the Air force. AF/A11 will actively posture our senior USAF leaders with the appropriate expertise to treat space as a warfighting domain and increase the speed of headquarters' decision-making. AF/A11 will also streamline operations and requirements decision making through the CSAF and the Joint Staff (vice OSD) to meet the demands of a warfighting domain.

Furthermore, as a service component to USSTRATCOM, AFSPC provides the Combatant Commander with the preponderance of its space power. In light of this, and in parallel with the stand-up of AF/A11, AFSPC/CC has been elevated to the Joint Force Component Commander for Space (JFCC Space) . . . in essence a 4-star Air Force commander focused on the joint fight. Additionally, the Joint Interagency Space Operations Center (JICSpOC) has transitioned to a National Space Defense Center (NSDC), effectively transforming the focus, resources, and energy from one of experimentation to warfighting operations.

NEAR TERM JOINT WARFIGHTING IMPERATIVES

The National Space Defense Center was placed under USSTRATCOM to better reflect its purpose, which is to defend and secure the space domain. Responsibility for the NSDC officially transferred from AFSPC and the Space Security and Defense Program (SSDP) to Joint Functional Component Command for Space under USSTRATCOM in fiscal year 2016. Funding through fiscal year 2016 was accomplished using the unfunded requirements process, and in fiscal year 2017 the NSDC was included in the fiscal year 2017's President's Budget. This organization entered its initial phase of operations in November 2016 following a series of experiments and exercises designed to explore, develop, and refine operational concepts and tactics, techniques, and procedures. In strong partnership with the Intelligence Community, the team has made great strides for the nation. The USAF has shouldered the preponderance of the resource responsibility in establishing the NSDC by freeing up facility space at Schriever Air Force Base, using USAF dollars and manpower to outfit those spaces, and providing the leadership that allowed for the execution of the experimentation phase. Furthering our commitment, we are now expanding the existing NSDC floor space, upgrading the underlying infrastructure, outfitting the information systems, providing a large portion of the manpower to establish an around-the-clock operational capability that will play a key role in deterring any adversary that might consider extending a conflict to space, and to ensure critical space capabilities for our forces should deterrence fail.

CONCLUSION

Space is no longer the sole province of world powers or a sanctuary for the U.S. It is a domain where barriers to access are rapidly disappearing. In the last decade, space has become more competitive, more congested and more contested, with potential adversary capabilities growing in number and sophistication.

In response to increasing challenges in the space domain, the Air Force is fully committed to increasing resilience and deterrence as we retain our competitive advantage over our strategic competitors. We have made tremendous advancements towards unifying efforts for efficiency as a resilient and responsive leader in the space domain—but admittedly, much work remains. In 2017, your Air Force will finalize our family of space warfighting Concepts of Operations, identify our capability gaps, continue our posture transition to increase deterrence, and ensure our force can fight and win a conflict that either starts or extends into space, and strengthen our support to Combatant Commanders. We are cognizant that the decisive advantage that space brings to military operations has been the deciding factor in every military operation conducted in recent years. Your Air Force remains committed to leading the space enterprise to ensure our joint warfighters can fight and win in every domain.

We thank the Subcommittee members for their support and look forward to our continued partnership to provide resilient, capable, and affordable space capabilities for the joint force and the nation.

Senator FISCHER. Before we begin, General, I would like to thank you for your recent column on our nuclear modernization. It was needed, and it is something that Senator Donnelly and I believe is very, very important. Thank you for putting that out.

We will begin the first round of questioning, please. I would address this to the entire panel.

How do each of you characterize the problems that we face with the organization of the national security space enterprise?

Madam Secretary, why don't you begin?

Secretary WILSON. Madam Chairman, as the Secretary of the Air Force, I am the principal adviser to the Secretary of Defense with respect with respect to space. I take that obligation very seriously.

There are some recommendations that the staff has been working on with respect to how to organize within the Air Force on space. There actually has been quite a bit of staff work done to make sure we are structured properly. I want to make sure that I review that well and get this right without signing something on day one. But I think there is a review underway of organization.

In general, I think the Air Force has been doing this for 60 years, and that 80 percent of what the Defense Department does in space is the United States Air Force. So we take the mission as a core mission.

Senator FISCHER. Thank you.

General?

General GOLDFEIN. Ma'am, I would say that, right now, we are in a strategic shift from treating space as a benign domain from which we monitor, sense, and report into a warfighting domain from which we fight should a war start in space or extend into space.

Where we are focused as a service and as the Department is in four key areas that we are looking at. All of them are linked when you look at the enterprise as we go forward.

The first element we are focused on is how we ensure that we have good, solid strategy and policy that we get that we then as a service can act upon and we as Joint Chiefs can act upon. From good strategy and policy, how does that actually then derive into a concept of operations a warfighting ConOps, if you will, that is written in the business of joint warfighting that is not unique and different because it is space, but it is actually integrated and normalized because we actually know how to fight in all of these domains.

From that ConOps derives solid requirements. With those requirements, we then have to acquire a pace that will allow us to be faster than our adversaries who are all investing in ways of taking away our advantage.

The final element that we are focused on is how we organize, train, equip, and present ready forces to the combatant commander so that that combatant commander, General John Hyten in this case, can fight should a war extend into space.

This is about looking at each of those elements, looking at the entire space enterprise, and looking at how we move it forward in an integrated way as we shift to a warfighting domain.

Senator FISCHER. Thank you.

General Raymond?

General RAYMOND. Thank you. I would just add that I agree with the framework that General Goldfein laid out.

I think, operationally, we are very sound. We are the best space force, and that should not be lost on anybody. I do think, though, with what we see with the domain becoming a contested domain, we have to have the ability to move fast. That is where my focus has been, to make sure that we have both the operational policies, processes, and procedures and the acquisition capabilities to move fast.

Senator FISCHER. Thank you.

Ms. Chaplain?

Ms. CHAPLAIN. Yes, as you know, I look at things from an acquisition perspective, so I might have a different point of view. But for acquisition, that is all about staying ahead of the curve, being agile, and being as fast as you can to delivery.

In that regard, we do see a lot of organizational challenges that need to be addressed. There is fragmentation in leadership for space acquisitions, no clear point of accountability or authority

when it comes to very complex efforts like the GPS [Global Positioning System] system. You have the military services involved. You have the Air Force involved in delivering a satellite. You have ground systems.

It is an extremely complex situation where you need a clear line of authority to prioritize systems, lay out clear plans, and we do not have that yet. As a result, you have pretty big gaps between the delivery of satellites and the delivery to ground. You essentially waste capability in space when you do that, so the fragmentation is a big issue in terms of our ability to stay ahead of the curve.

Within that structure, we often hear that there are too many people down the acquisition line who can say no and that the process is not streamlined enough. Some of those issues are common to all weapons systems, but they are very particularly evident in space because you actually have more players involved in a space system and more players involved in the acquisition process.

Senator FISCHER. Thank you.

General Greaves?

Lt. Gen. GREAVES. Madam Chairwoman, in addition to what Secretary Wilson and Chief of Staff Goldfein and General Raymond commented on, I would only like to add that our decision-making process is what we are currently addressing to ensure that we can streamline it and make decisions affecting the acquisition timeline in a quicker manner.

Thank you.

Senator FISCHER. I would put this question out to any of you who would like to respond. Do you feel that there are criticisms that are being made on the structure that you think are unjustified?

General Goldfein?

General GOLDFEIN. Ma'am, I would not say that they are unjustified. I will tell you this, that right now, as we make this transition from a benign to a warfighting environment, I would just offer to you that any move that actually ends up separating space as opposed to integrating space I would argue is a move in the wrong direction, because if I was the Chief of Naval Operations, the Chief of Staff of the Army and my fellow Joint Chiefs and I were sitting here, I would tell you for all of the missions that we as Joint Chiefs do in the business of combined arms against an enemy, space is absolutely essential to every one of our missions.

The last thing we want to do is actually separate space into something unique and different with its own unique lexicon. Right now, where we are focused is how you further integrate it and how you take the tried-and-true methods of joint warfighting, apply them to the space domain, and ensure that it is normalized across all of these mission sets.

So it is not really that it is an unjustified criticism. I just want to make sure that we are moving the Nation in the right direction, which is to integrate space.

Senator FISCHER. Do any of you feel that there have been any issues in prior studies, like the Rumsfeld Commission, that may have been missed, overlooked, left out?

Madam Secretary?

Secretary WILSON. Madam Chairman, some of the recommendations for action in these different reports are actually contrary to

each other. The structure of acquisition and operations that currently exist with space was a recommendation of the Rumsfeld Commission, which was then implemented. Some of the other recommendations are not consensus recommendations.

So these are controversial and difficult issues. I do not think we should shy away from that. We should analyze them clearly and try to look at what the enterprise needs now and structure in order to achieve that.

I think General Goldfein is right. We need to make sure that space is fully integrated and rapidly available.

Think about this, what happened last weekend. This country had between 5 minutes and 8 minutes to identify and characterize a launch from North Korea and then decide what to do about it. That has to be integrated, and we have to do this along the lines we have done joint warfighting since Goldwater-Nichols.

Senator FISCHER. Thank you very much.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

Secretary Wilson, Air Force Space Command is responsible for training and equipping our airmen to perform the Air Force's space mission, but the command does not have authority for setting requirements and overseeing acquisition related to their mission. Is that a problem?

Secretary WILSON. Senator, I do not think the current structure is a problem. It is a result of one of the recommendations of the Rumsfeld Commission that was implemented in the Air Force.

That said, you constantly review organizational structures based on the needs at the time. Perhaps General Greaves or General Raymond might have something to add to that.

Senator DONNELLY. Great.

Lt. Gen. GREAVES. Senator, I would add that having the acquisition element within Air Force Space Command is a great advantage, and having my position report directly to the four-star Air Force Space Command is a great advantage, because by working for him, the requirements that are generated at Air Force Space Command immediately flow down to the Space and Missile Systems Center, which we then work with the Command to turn into contracts to produce capability while working with Headquarters Air Force, so I see that as an advantage.

Senator DONNELLY. Okay.

General RAYMOND. I would pile on. I do have requirements, responsibility on the requirements officer, if you will, for Air Force Space Command, and working through the Chief is the Air Force requirements officer. I provide General Greaves with those requirements. I provide him with resources. I provide him with manpower. I have a pretty strong voice in that chain.

Although I am not in the acquisition chain or machine, if you will, I influence that pretty significantly and have been able to do so on several big programs over the first 7 months of my time in command.

Senator DONNELLY. Okay. Thank you.

General Goldfein, some space advocates these days are calling for space corps, something like the structure of the Marines within the Navy. Do you support that or do you think we should take a pass?

General GOLDFEIN. Sir, I do not support it at this time in our history based on where we are in this transition from a benign environment to a warfighting domain.

I will tell you that my sense is that we have an opportunity being placed in front of us right now to take a look at what is the way we fight in the air, on land, at sea, and we know how to do this business, and how we take those processes, procedures, tactics, techniques, and actually apply them across the space domain. Right now, to get focused on a large organizational change would actually slow us down right now.

Whether there is a time in our future when we want to take a look at this again, I would say that we probably ought to keep that dialogue open. But right now, I think it would actually move us in the wrong direction and slow us down from where we need to go.

Senator DONNELLY. General Greaves, one of the lesser-known space missions for the Air Force is providing unique weather data for military needs. For the past several years, this committee has expressed concerns about the Air Force's impending gaps in EO/IR [electro optical and infrared] sensing data for cloud cover and theater weather imagery, particularly over the CENTCOM [Central Command] area of responsibility in the Indian Ocean.

The plan seems to change every year. What is it currently?

Lt. Gen. GREAVES. Thank you, Senator. As part of the acquisition responsibilities at SMC, we have a range of authorities that we can draw on. We have listened to the feedback from the Congress. Working with General Hyten at STRATCOM [Strategic Command], we have developed a plan to use one of the authorities that fall under SMC [Space and Missiles Center], operationally responsive space, ORS [Operationally Responsive Space], to use those authorities to speed the delivery of an interim capability to address gaps one and two, theater weather imagery and cloud cover. That is in the works as we speak.

Senator DONNELLY. It is my understanding that the available GOES [Geostationary Operational Environmental Satellite] assets are aging, and that they will provide a short-term solution right now to the problem. Do Air Force acquisition plans include a longer term solution to meet CENTCOM's needs, something along the lines of 10 to 15 years or more?

Lt. Gen. GREAVES. That is correct.

Senator DONNELLY. Okay. Thank you.

Ms. Chaplain, what have your findings been on the Air Force's long-term weather acquisition plan?

Ms. CHAPLAIN. Weather is actually a good illustration of some of these problems we talk about with fragmentation. They have been very slow to actually study what is ahead for weather. Some of that study process was hampered by the lack of coordination with agencies, principally NOAA [National Oceanic and Atmospheric Administration]. That led to an incorrect assumption about the availability of European satellites. It slowed the study process down further. We have 2 to 3 years of study before we can even start a new program. There is still a lot of uncertainty ahead.

That is where we are at. We are just waiting to see what they do. The decision-making process has been very slow.

Senator DONNELLY. General Raymond, do you believe Space Command should become a functional component of the U.S. Strategic Command so that the Air Force Space mission is part of the warfighting responsibility of STRATCOM?

General RAYMOND. I absolutely do. That is part of a larger command and control restructure at STRATCOM.

I served previously at STRATCOM. General Hyten is the STRATCOM commander. Today, he has about 18 different component commands, ranging from an O–6 to a four-star general. This is going to streamline that. It is going to elevate the operational commander from a three-star for space, from a three-star to four-star, align that with me, align the service component responsibilities with the forces component responsibilities, strengthens my voice in joint requirements, and I am fully supportive.

Senator DONNELLY. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator.

Senator Rounds?

Senator ROUNDS. Thank you, Madam Chair.

First of all, thank you all for your service to our country.

Secretary Wilson, welcome aboard. It is great to see you at our first hearing. This is special.

I have a couple questions. First of all, I agree, General Goldfein, that, clearly, we will have basically a contested domain in space. I am just curious, the GPS, Next Generation Operational Control System is an item I think—or at least the GPS system we have today is clearly at risk and would be an item to be targeted by any of our adversaries.

Thinking of GPS and other data-gathering or transmission systems that are in space today, we use them almost like infrastructure today. If someone attacks or could attack, and we talk about this being basically an area where we could fight a war, clearly, we have individual nations in mind. Who are our closest adversaries with regard to having a battleground in space?

General GOLDFEIN. Right now, in terms of who we are watching and what their investment is, clearly, those who are furthest ahead are China and Russia. So they have been watching since Desert Storm. They have seen how we use capabilities from space. They have studied our reliance on space. They are clearly investing in ways to take away that advantage.

Beyond that, Senator, I would love to get on your schedule to give you a classified briefing on a little bit more detail of what we are seeing.

Senator ROUNDS. I think why I ask it now is because it has to be made very clear that we have resources in space that what they would try to deny us. One of the reasons we have talked about it is that we are in the process, in fact, in a very challenging process, with the GPS Next Generation Operational Control System. It is probably, as suggested by GAO, perhaps the most problematic Air Force program that we have.

A little over a year ago, General Greaves called it the number one troubled program within the Department of Defense. The program is nearly $2 billion over budget, and at least 4 years behind schedule. In October 2016, the Department completed a Nunn-

McCurdy review and certified to Congress that the OCX [Operational Control System] was essential to national security, which I think you are reinforcing here today, no alternative would provide acceptable capability at less cost, and that program's revised cost estimates were reasonable.

I understand that the assessment from the most recent government review is that the program is making acceptable progress, but it is by no means out of the woods.

Is the OCX program too big to fail?

General GOLDFEIN. Sir, if I could, because you have raised some great issues here about space resiliency, if I could take a minute and talk about just basic defense of our systems, and then turn it over to General Raymond and General Greaves on the specifics associated with GPS and OCX.

We actually as a service know how to do layered defense of critical infrastructure. If you were to walk to Bagram Air Force Base today, you would see a commander who can walk into a headquarters and have situational awareness on things that are going on out to 100 miles from that base and various layered defenses that we put in place all the way up to, at the wire, and inside the wire.

That is the same mindset that we have to apply toward layered defense of our critical space systems. That is where we are moving now, to look at not only that layering but at also how we build resiliency and, perhaps as important, how we ensure that we train this force so that if a portion of that enterprise is denied or taken away, we can still fight and operate, and we do that every day. So this is about resiliency in the overall space architecture.

Finally, I would say that you captured this right, in that as you look at any space constellation, there are three elements that we have to look at how we defend in a layered way. First of all is what is actually in space and what orbit we have to defend. Then you have to look at what has been integrated on various platforms that use that information—some that fly, some that run, some that steam, some that submerge. Then you have to look at the ground control stations that receive that data, and all of those have vulnerabilities that we have to protect.

Senator ROUNDS. So it is fair to say that it is too big to fail?

General RAYMOND. I would say no program is too big to fail. I would tell you the mission is too big to fail. The importance of being able to access GPS III, and the resiliency that that provides, is too big to fail.

We have programmatically built off-ramps to be able to go a different direction, if this were not to continue to progress. I will not be comfortable until that capability is operational on an operations floor. But it is a very important mission, and I will tell you we are laser-focused on it to make sure that it materializes and then have alternative paths if not. General Greaves can talk to you more about those alternative paths.

Lt. Gen. GREAVES. Yes, Senator, this program is absolutely not too big to fail. In fact, when we looked at it as a Department within the Department of Defense late 2014, early 2015, we understood that this GPS III operational control ground segment was the first information assured, really hardened capability that we were going

to deploy to protect against both the outside and inside threats. So we knew that.

We also knew that as we looked at the criticality of this system, we needed to build off-ramps. General Raymond mentioned some of those. We had milestone-driven off-ramps. So we looked at whether or not, if the system was delayed or we had to cancel the program, whether or not we would have control over the new GPS satellites. We entered into a contract with industry to develop a contingency operations capability, which will allow us to fly the GPS III satellites as legacy satellites. That was one milestone that we made a decision on.

We also had a decision to make on whether or not the block zero of OCX, which is used to launch and check out the satellites initially, whether or not that would remain on track. That has remained on track. It is going through final testing now, and it is going to be ready to support the first launch next year.

We also looked at our military code, whether or not the delays in OCX would impact the deployment of M-code. We also let a contract to start that effort to ensure that would be in place.

Senator ROUNDS. If I could, I do not mean to cut you off, I am going to run out of time and I want to be careful of that.

I think the critical part here is that we have a GPS system, which we rely on today, which I believe you would say is at risk. What we are trying to do is find a way to protect it. This is one of those tools that is necessary in order to create our ability to respond and fight the war that we have become used to over the last 25 to 30 years. Fair enough?

Lt. Gen. GREAVES. Yes, sir.

Secretary WILSON. Senator, fair enough. We are not out of the woods on OCX yet, which is one of the reasons why there is a quarterly review at the Secretary of Air Force level to make sure that this program stays back on track, so it has a very high level of visibility of oversight within the Air Force to get it to his operations floor.

Senator ROUNDS. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator.

Senator Peters?

Senator PETERS. Thank you, Madam Chair.

Thank you to each of our panelists for being here today.

I will join my colleagues in congratulating Secretary Wilson on her appointment. We look forward to working with you. It is great to have you here. I will extend once again the invitation that I extended to you when I had the opportunity to meet with you in my office, to come to Michigan to Selfridge Air National Guard Base, in particular, given the fact your father served at Selfridge. We would love to have you back.

Just to put it out there, they are celebrating their 100th anniversary this August, so we will talk to your scheduler about a visit, which would be really wonderful. I am proud to say the Air Force Thunderbirds will be performing that day as well. Hopefully, you can be there.

I want to talk a little bit about some other threats that we face from space, in addition to some of the military threats we have

talked about. That deals with space weather. We have heard about weather forecasting on Earth, but threats that come from space, from the sun particularly, solar flares and potentially mass coronal ejections that can have a devastating impact on the Earth.

The Senate unanimously passed legislation that I worked on with my colleague Senator Gardner in a bipartisan way to coordinate the various agencies that have oversight of this potential problem from NOAA [National Oceanic and Atmospheric Administration] to NASA [National Aeronautics and Space Administration], to the Science Foundation, the Department of Defense, and FAA [Federal Aviation Administration]. This has a big impact from the Department of Defense perspective for situational awareness as well as mission planning. We know that it is just a matter of time before a very big storm occurs. I am happy to say the University of Michigan is one of the leading institutions studying heliophysics and the potential threat that this has.

Whoever would like to comment about the importance to the Air Force of having some accurate space weather forecast, where do you see us in that regard? Are you concerned?

I have been told that our space weather forecasting ability is equivalent to our hurricane forecasting ability in the 1930s, which was not that good in 1930. If it is that way for us here today, particularly given the interconnectedness that we have and the fact that the electrical grid could be wiped out through a large part of the United States should the storm hit, what should we be thinking about? Does the Air Force have the resources that you need? Should we be thinking about adding to those, if not?

General RAYMOND. First of all, I would just say thanks for the question.

Space weather is very important to our operations, both in space and in the air and all the domains. We take this very seriously.

I would have a slightly different characterization of where we are in relation to hurricanes in 1930s. We have space weather experts in our Air Force that sit right on the operations floor that we operate. They provide us very timely information on space. We provide that warning across our forces.

When I was deployed, and General Goldfein talked about when he was at SEAFAC [Southeast Alaska Acoustic Measurement Facility], when I was deployed as the director of Space Forces, we had space weather folks there as well that could help us shape operations to be able to operate and continue operations in that environment.

As you know, space weather goes through cyclical periods. The current period that we are in now is not all that high. But as you said, there will be periods where we will get increased solar activity.

Lt. Gen. GREAVES. Senator, let me add that the Air Force is very serious about this. We have been directed, for every new space system that we are deploying, to have energized charged particle sensors on board to help characterize the environment that those spacecraft will fly, which will then help with the modeling that we have to do on the ground to do predictions.

Senator PETERS. Thank you. I will look forward to continuing to work with you. I think the forecasting, the analogy to hurricane

forecast is a very large impact like we had back in 1859. Folks at the University of Michigan and others have talked about that catastrophic impact.

Lloyd's of London has made a risk assessment that, if a storm of that magnitude hits, it would be over a $2 trillion impact to the United States economy. Apparently, we missed one by just a few days just a few years ago. That is the area where we are concerned about and why this legislation has been moving forward, to work with you on that.

General RAYMOND. I totally agree with the criticality of being able to do that right.

Senator PETERS. Thank you.

The other thing, and, General Goldfein, you talked about how the domain that we are dealing with now is different from what we thought about it in the past. This is a contested domain that we have to harden our satellites. We have to harden our assets that the Air Force has.

The question came up from Senator Rounds and others about the GPS system. But that leads to a broader question. We have an awful lot of commercial satellites in space as well that are critical infrastructure. Those would be considered particularly soft targets, I would expect, that an adversary could target.

How do you think about hardening our space systems, not just from the DOD assets but understanding that significant civilian assets also could potentially pose a real threat to our country, if they are targeted?

General GOLDFEIN. Yes, sir. I think the first important step is to make sure that we acknowledge that this is truly a partnership and that there are those who are operating in space beyond the traditional state actors that we were growing up with perhaps earlier in our careers, and especially as commercial gets more and more interest in space and is launching more of the smaller satellites. When we talk about it being more of a contested and congested place, that is probably what contributes as much as anything to it being more congested as we operate.

There is a question of whether it is more challenge or opportunity. I would offer to you that as we see space, as we see commercial entities getting more and more in the space business, there are probably more opportunities than challenges as we work with them in public-private partnerships looking at potential for other launch capabilities, looking for the smaller digitization of satellites that allow us to actually get capability, actually leveraging what they are doing commercially that could actually contribute to military operations.

All of those things are ongoing. As the Chief of Staff of the Air Force, and as a Joint Chief, I look at the public-private partnership opportunities ahead as we go forward, in terms of continuing to normalize how we operate.

Senator PETERS. If I may pick up on the comment that you made regarding crowded space, the crowded place up there with all the satellites, my understanding is that India recently launched 104 satellites from 1 rocket—101 of them were smaller nanosatellites, including 96 from various United States companies and commercial enterprises.

I understand it took a significant amount of time to track and find these objects, to keep track of them. That leaves the question of space debris, all sorts of things that are happening.

Could you give me a sense of where we are in dealing with that issue? The Air Force I know has taken primary responsibility in tracking a lot of these objects. Should we continue to do that? Is there something else we should be thinking about? Because this will likely accelerate in the years ahead.

General RAYMOND. That is another great question.

Space is clearly a congested domain. We track about 23,000 objects each and every day, 24/7. We take about 400,000 observations a day to keep track of that. About 1,400 of those objects are satellites. About 75 percent of those are maneuverable.

This is a CubeSat. You talked about the 109 that were launched on the one rocket from India. We are seeing trends of smaller satellites. This satellite goes 17,500 miles an hour in orbit.

We work very hard to be that space traffic control, if you will, to keep the domain safe for all.

On average, about once every 3 days, a satellite repositions to keep from hitting either a piece of debris or another satellite. On average, about three times a year, the International Space Station maneuvers to keep from hitting a piece of debris. It is something we take very, very seriously.

I will tell you the airmen and joint forces that are assigned to the Joint Space Operations Center out at Vandenberg do that work each and every day and keep the domain safe for the world.

Senator PETERS. Thank you.

Senator FISCHER. Senator Peters, did you return that satellite?

Senator PETERS. Yes, I did.

Senator FISCHER. We do not need another one, right?

Senator Sullivan?

Senator SULLIVAN. Thank you, Madam Chair.

I want to thank the panel. It is a very impressive group of public servants and military officers.

Secretary Wilson, welcome. We are all glad to see you here in your position. I think you always hear this from different Senators, like Senator Peters. I look forward to you coming up to Alaska. You will see that we are the hub of air combat power for the Asia-Pacific and the Arctic and training with JPARC [Joint Pacific Alaska Range Complex].

The young men and women in the Air Force in my state, as you know, have been very busy with five F–22 intercepts of Russian Bear bombers just within the last month. They are doing a good job protecting American sovereignty and airspace.

Thank you for the great leadership all of you are doing with regard to the young men and women who are doing such a great job.

We are also a cornerstone of our Nation's missile defense up in Alaska. I want to talk a little bit about missile defense and what we can be doing better on that.

It has become very clear, and you were talking about the test by North Korea this past weekend, but all the public testimony is it is not a matter of if but when Kim Jong-un is going to be able to range the United States, and it is not just Alaska and Hawaii but the lower 48, with an intercontinental ballistic nuclear missile.

That is going to happen at some point. He is going to have that capability.

I think that we need to do more to be able to protect the Homeland, to be able to say that, if you lunch 1, or 2, or 3 of these missiles, that we will have a 99 percent chance of shooting them down, and then we will massively retaliate against you, which I think will keep even a crazy guy even a little bit more sane, in terms of trying to do something like that.

But I do not think we are there yet, so I think we need to do more, and I am going to be introducing a bill that we have been working on for months with some of the experts in Washington and other places on increasing our missile defense capability. I am certainly going to look to make that a strong bipartisan bill.

One element, actually a key element of that bill, relates to the topic we are talking about here, and that is space and space sensors with regard to our missile defense.

General Goldfein, you articulated well the idea of an integrated and layered defense. But, as you know, it is not just Bagram Air Base. It is also our missile defense that we need to do that.

General Hyten has stated in testimony that, "The deployment of a global space-based sensor system with discrimination capability will be a critical component to improving the effectiveness of our deployed missile defense interceptors." That is his testimony.

Admiral Syring similarly stated, "From a missile defense perspective, we have to develop a future operational space layer. Given where the threat is going with hypersonics and more ICBMs [Intercontinental Ballistic Missiles], this persistent tracking and discrimination capability from space is a must for our missile defense."

I would like to ask the whole panel—maybe, General Raymond, starting with you—how would space-based sensors benefit our missile defense system, help with a layered and integrated defense, whether it is GBIs [Ground-based Interceptor] in Alaska or THAAD [Terminal High Altitude Area Defense] throughout the world, South Korea, or Aegis Ashore, Patriot? How is that important?

Would that give us the persistent, unblinking eye and a stronger ability to have layered missile defense, which in my view we need today? We need it today, and we do not have it. How critical are space sensors in that regard?

General RAYMOND. I think it is very critical. I would agree with the previous testimony that you cited. I think space, if you look at the little handout that we provided and you look at the orbits, space provides persistence. Space provides that unblinking eye. Space provides the ability to discriminate, especially for maneuvering targets.

We have a great partnership with MDA [Missile Defense Agency]. In your State, Senator, we have a missile warning radar. We are in partnership as we speak with MDA to modify that to be a more capable missile defense capability, so we have a long partnership both on the ground. We have capabilities in space today with our space-based infrared satellites and with our defense support program satellites, DSP [Defense Support Program] and SBIRS

[Space-Based Infrared System], that provide utility to the Missile Defense Agency.

But the layer that you talked about I think would be important. It would give you persistence, field-of-view, and the ability to discriminate.

Senator SULLIVAN. Anyone else want to comment?

General Greaves?

Lt. Gen. GREAVES. Senator, I will agree entirely with General Raymond. Space and Missile Systems Center has been in very close contact with the Missile Defense Agency over the past few years, understanding where we can partner and where space can benefit.

Space offers the opportunity from its vantage point for the promise of birth-to-death tracking, which aids in the discrimination problem that is at the central core of the efficient use of our interceptors. We have been working, some of it is classified, with MDA to hopefully jointly determine what would benefit the missile defense mission as well as the space surveillance mission within the Air Force, so that work is ongoing.

Senator SULLIVAN. Great. I think you will like—I am not going to presume that you will support this bill, but from the testimony, I think you will appreciate what we are trying to do here in the Senate.

Ms. Chaplain?

Ms. CHAPLAIN. Yes, I also oversee our missile defense work. The capability that you are talking about, there has been a requirement for that since the 1990s. There have been several attempts to actually build that constellation. One issue is it is very expensive to get that capability because it is usually in low-Earth orbit and you have to put up more satellites.

One issue that has sort of been recurring——

Senator SULLIVAN. Just to make a point on that, we have been looking at some of the costs, and my view is, buying insurance with regard to a nutcase who wants to try to nuke Chicago at some point, or threaten to do it, the expense should not be our first priority. Defending the Nation should be our first priority.

I understand we have the capability to do it, and I think, as you have been talking about, we have been talking about it since the 1990s. This bill is meant to say let's do it. Enough talk. We have a threat. We have a threat, a real threat right now, a madman possibly could be threatening 300 million people in the next year or 2 with an intercontinental nuclear ballistic missile.

I just get a little tired of the discussion of, "Well, it is going to cost a little bit more." I think the average American would take that insurance policy in a heartbeat to say we have a 99 percent chance of shooting down a missile when right now we do not.

I do not know exactly what you believe the number is in terms of our chances, but we need to up the chances and the probability of being ready to take out any threat that this guy daily—daily—threatens our country with. We should not take those threats lightly.

Ms. CHAPLAIN. I think, given the expense, though, you can maximize that satellite's use by bringing in other requirements. One up for discussion is base situational awareness. The same satellite can

serve different communities. It helps you be able to pay for that mission even more.

General RAYMOND. We are working very closely with Missile Defense Agency toward that end.

Senator SULLIVAN. Madam Secretary, any comments?

Secretary WILSON. Senator, I would just say one thing. You have highlighted the need to do more. All of these things and other missions for the Air Force, we are not going to meet the needs of the Nation unless we figure out a way to get beyond the Budget Control Act. That is going to require a lot of work between the Congress and the Administration to figure that out.

Senator SULLIVAN. Thank you.

Senator FISCHER. Thank you, Senator.

Senator Heinrich?

Senator HEINRICH. Thank you, Madam Chair.

Secretary Wilson, General Goldfein, in your testimonies, you state that current policy does not fully address space deterrence requirements for action in the 21st Century. Given the reliance we have today, and it has been discussed by a number of you, for space, for secure communications, intelligence collection, missile defense, GPS, and many other missions, what are your thoughts on whether it is time for the United States to engage in an international conversation about an international space code of conduct and whether we should be negotiating with other nation-states on such a thing?

Secretary?

Secretary WILSON. Senator, that is probably a policy issue far beyond the Air Force. The Air Force's role will be to be ready to defend what we believe will be a contested environment irrespective of any international norms of behavior. I think the Air Force intends to and does comply with national norms of behavior and, in fact, enables a lot of those norms by providing information on where debris is and so on and so forth. But we must——

Senator HEINRICH. Do you have thoughts on potential pitfalls or potential advantages of having such a code of conduct in place?

Secretary WILSON. Senator, I have to say that from an Air Force perspective, I think what we have to do is to be able to prevail in what will inevitably be a contested environment irrespective of consensus on international norms, because there will be players who do not abide by those norms.

Senator HEINRICH. Yes. It is about risk mitigation more than anything else. That is why I asked the question.

General?

General GOLDFEIN. Thanks, Senator. In some ways, the intent of the National Space Defense Center when it began was to actually take a look at how we coordinate our activity beyond just the Department of Defense for other operations that are taking place in space.

Right now, it is centered on defense and intelligence and taking a look at not so much who commands and who controls but actually at how we coordinate our activity. An international set of norms relative to how we coordinate activity beyond defense and intelligence is probably a reasonable dialogue to have.

But I am with the Secretary here. That is probably a policy-level discussion.

Senator HEINRICH. One of the GAO's recommendations is to delegate decision-making to the lowest level practical. Do each of you agree with that recommendation? Do you think that this extends to the hiring of qualified individuals and the issuance of contracts?

I will give you a little background. The reason why I am bringing this up is that in addition to the delays in issuing contracts, I have heard a lot from recent graduates about significant delays, sometimes over a year, in terms of extending a job offer.

Just last week, a number of my colleagues and I sent a letter to Secretary Mattis about direct hire authorities, urging that each of you help implement those authorities across-the-board within the Air Force but particularly concerned about AFRL [Air Force Research Laboratory].

I just wanted to get your sense for how you view that recommendation and how far you think it extends.

Secretary WILSON. Senator, in general, yes. The decision-making should be at the lowest practical level. In that regard, I would highlight the acquisition authority that was just recently returned to the Air Force. We are working that through with the Department of Defense now.

With respect to hiring, I am not sure what the cause was behind what you identify. But remember we also just went through a hiring freeze and also an uncertain budget situation. Sometimes those decisions are based on the fact that we just have no certainty with respect to the budget, and budget certainty does affect managers' decisions.

Senator HEINRICH. Absolutely. My understanding is that was not the case, but we will get you those details, so you fully understand the situation.

General GOLDFEIN. Sir, I will let General Greaves and General Raymond talk to the specifics on acquisition and decision speed and decision authority.

What I would like to highlight for you is the importance of looking at this from both requirements and acquisition, because to acquire, you have to start with a very firm set of requirements. Here is where I think we have to get to. The analogy that I would offer you is that today we are building a tanker called the KC–46. We are not building that for the United States Air Force. We are building that for the joint force because anybody who needs airborne refueling is going to use the KC–46, to include our allies and partners.

The chief requirements officer for the KC–46 is the Chief of Staff of the Air Force. If anybody wants to change the requirements, they have to come to me to change those requirements.

We have to get to the same level of decision authority and deliberate oversight of requirements in the space business the same way that we acquire others. As we work our way through decision authority in acquisition, there is an equivalent discussion we need to have about decision authority for holding requirements firm.

General RAYMOND. I would pile onto that. I think strengthening requirements at all levels is important. I think the other piece of this that is important is making sure that we have the analytical

rigor to inform those requirements. When we have that analytical rigor, we have been able to move pretty rapidly. Then I would also add that we are also focused on using rapid acquisition authorities more broadly than what we have done in the past.

Senator, in your State, we have the Operationally Responsive Space Office, and we are working hard to use those authorities more broadly.

Senator HEINRICH. Great.

Lt. Gen. GREAVES. Senator, as the Commander of SMC, I think the single biggest improvement we can make you have already provided language for. But as Secretary Wilson said, moving the milestone decision authority back to the services, and as the Secretary said, we are working within the Department to execute that.

As far as contracts, I know specifically with our advisory and assistance contracts, our support contracts, 3 or 4 years ago, there was a problem with those contracts. Within the last 3 years, we optimized and consolidated the requirements process that generates those contract awards. We have seen a drastic reduction in the time needed to award those contracts, so we are addressing those.

Thank you.

Senator HEINRICH. Thank you, General.

Senator FISCHER. Thank you, Senator.

Senator Warren?

Senator WARREN. Thank you very much, Madam Chair.

Thank you all for being here.

Secretary Wilson, it is good to see you here. I hope we are going to get to see you in Massachusetts as well. You have a standing invitation to come visit our bases. I want to make sure we get our plug in too for Massachusetts.

I want to talk about where we are right now with the commercial sector. The commercial sector seems to be charging ahead in space. One area where commercial advances have been astounding has been in imagery. Today's commercial satellite imagery is often very high quality. They are even taking HD [high definition] video from space.

Meanwhile, our intelligence surveillance and reconnaissance is what I understand the Pentagon calls a high-demand, low-density asset, which means everybody wants it and there is not enough to go around.

So let me start, General Goldfein, if I could, how is the Department incorporating commercial imagery as a service into its approach? Conversely, how do you think about the risks that the wide availability of imagery pose for the United States?

General GOLDFEIN. Yes, ma'am. The reality is we sense the globe in domains: air, land, sea, space, cyber. Then someone has to take all those ones and zeros and turn it into decision quality information to allow us to achieve decision speed. Much of that falls on the Air Force. We are continually looking at ways to integrate nontraditional means of intelligence into that sensing so that we can fuse that into this common operational picture.

I will tell you that we are using commercial imagery. We are using other sources that can bring—we are using social media in ways that we have not before, so this is a broader discussion about how you leverage public-private partnerships and the commercial

industry to be able to increase your decision speed and your ability to get that common operational picture.

Senator WARREN. Let me then just follow up on that a little bit, General. Our satellite programs are incredibly complex. They are also incredibly expensive. Oftentimes, a single satellite can cost billions of dollars. Meanwhile, the advances in technology on the commercial side are making sophisticated technology smaller, lighter, cheaper, every day.

A little startup company in Massachusetts can buy a small, lightweight CubeSat—I think you said you have one of those here—for less than $10,000, and it does not cost much more than that to launch it into space.

I get it, that a CubeSat obviously does not have the same capabilities as the next generation GPS, but it seems like there are some missions that a smaller or less technically sophisticated satellite would do just as well.

Maybe I could include you in this, General Greaves. How do you assess the tradeoffs between large, technically sophisticated satellites and smaller but potentially less powerful constellations? How do you think about that?

Lt. Gen. GREAVES. Senator, we actually think about that daily, and it is part of our acquisition strategies that we develop.

Just one example, one vignette, for the space-based infrared system that flies out of Colorado, we are setting up a data framework consortium to essentially go after commercial capability to integrate into our tools, applications, and processing lab to essentially ingest commercial data, whether it is imagery or OPIR [Overhead Persistent InfraRed] or other sensors, and combine that with what SBIRS produces, as an example, and exploit that and fuse it and send it out to users. That is just one example.

Senator WARREN. I have to say, I am really glad that you are thinking about this and you think about the ways that you can integrate.

It seems to me that a high-low mix of advanced and more basic capabilities in our satellite inventory would be a good way to think about it, kind of the same way we think about aircraft in this area. Capitalizing in advances, though, in technology is possible only if we can afford to do it.

But, Ms. Chaplain, a lot of our space acquisitions seem to remain bogged down. Last year, the GAO reported that several of the Department's most critical space programs remain overbudget and behind schedule. Ms. Chaplain, could you say a word about how the Department, what it should be doing to stay on schedule and to rein in costs in this area?

Ms. CHAPLAIN. I think a two-pronged approach is needed.

One, you really need to focus on the acquisition fundamentals. In recent reports, we are hearing issues about systems engineering, contractor performance, lots of management and oversight issues that seem to persist. Those really need to be addressed.

Then on the second-pronged approach, really looking at the fragmentation and leadership so that we can speed up decision-making, be more agile, get agreements early on. That does not really happen as much as it should on space.

I agree with you about the commercial suppliers, and can they be brought in to offer a mix of approaches? For years, commercial suppliers have always felt like it is "talk to the hand" when it comes time to deal with the Department of Defense. Maybe you have heard of that. There is also a lack of contracting mechanisms to help them engage with defense, especially when it comes to things like buying bandwidth or something like that.

DOD has been trying some prototype efforts to be able to buy services better, but I think a lot more can be done to bring in that kind of innovation.

Senator WARREN. Good. I am very glad to hear this. Obviously, the cost growth in the satellites is limiting our capacity to buy what it is that we need to buy. We owe it to the taxpayer, we owe it to our national security, to get these costs down to a place that we can get the full range of response that we need.

Thank you all very much. I appreciate it.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator Warren.

I believe we have some time left in the hearing. There might be other Senators who are going to be coming to ask questions, so we will begin just a short second round, if Senators have a follow-up question.

I would recognize Senator Sullivan.

Senator SULLIVAN. Thank you, Madam Chair.

General Goldfein, I just want to follow real quick on a statement you made about the KC–46 and your authority on the requirements change.

Was that as a result of the NDAA [National Defense Authorization Act] amendments just 2 years ago on acquisition reform to give the Service Chiefs more authority on acquisition?

General GOLDFEIN. Actually, it did strengthen the authority of the chiefs. Actually, I would argue, it also strengthened the accountability of the chiefs for having responsibility for assigning milestone decision authorities.

However, the responsibility of the chief of staff of a service to hold requirements firm actually did not change with——

Senator SULLIVAN. That had previously existed?

General GOLDFEIN. Yes, sir.

Senator SULLIVAN. Okay. Thank you.

I want to go back to the missile defense discussion we were having. General Raymond, I was talking a lot about space-based sensors, but given your experience—and again, I would open us up to the panel—and given the threat that is heightened that we are all acknowledging, particularly from North Korea, can you talk about why some of the ground-based radars like Cobra Dane and the upgraded early warning radar and the LRDR [Long Range Discrimination Radar] radar that we are implementing now are also very important with regard to our layered, integrated, and strategic missile defense?

General RAYMOND. I think as you just ended the question, layered defense, that is really what this is. This is a network or a system of systems. Every piece of that architecture provides advantages. From the space capabilities, as we talked about, you get the

persistence, you get the field of view. From the ground-based radars, you get discrimination, better discrimination capabilities.

There are a host of sensors that are positioned around the globe to be able to do that. They come together as a network to be able to fuse that information into a timely decision and be able to respond as a Nation in order to do so.

But it is not just one capability. It is the mixture of those capabilities that provides the national missile defense capability that we need.

Senator SULLIVAN. Cobra Dane, is that in good shape? How important is that to tracking North Korean missiles right now?

General RAYMOND. Cobra Dane, let me just say, I am not responsible for missile defense mission. However, I will say that it is a very important missile defense capability. I would also tell you that we use that capability pretty significantly to do space situational awareness as well. I talked about earlier the thousands of objects that we are tracking. We use that capability for that mission as well.

Senator SULLIVAN. Anyone else want to comment on this ground-based—General Greaves?

Lt. Gen. GREAVES. Senator, I would offer that the discriminating radar that is going into Clear, Alaska, is key to the future of effective missile defense. I believe that is why Admiral Syring proposed that it be positioned there, because it is a mix of, if you add the SPX [Semi-Based X-Band] floating, X–Band Radar, mix of phenomenology that is used to characterize the threat versus decoys, and radars are critical to that.

Senator SULLIVAN. Thank you.

General RAYMOND. The other piece of this is that you also need, as we talked about earlier, when there is a launch, you have to determine really quickly, is it a regional threat? Is it a threat to our Homeland? Or is it a threat to space? Or is it a space launch?

Those capabilities, wherever they are around the world, help us discriminate against that and then provide us the—help support the supporting relationships to handle those.

Senator SULLIVAN. Did you have a comment, General Goldfein?

General GOLDFEIN. Sir, I was just going to say, in my role as the air defense commander in Central Command and responsible for defending the Arabian Gulf from potential Iranian missiles, one of the things that we have not talked about in this discussion is the importance of attribution and ensuring that not only do we characterize the missile very quickly so we can defend, but also so we can have irrefutable evidence that we can present that said it came from this country.

Senator SULLIVAN. Right.

Let me just ask one final question, Madam Secretary, if I may, just since the two leaders of the Air Force are here. How is morale with our young men and women in the Air Force, for both Madam Secretary and General Goldfein?

Secretary WILSON. Senator, I am probably not able to comment on that yet in any detail, because I have not been out in the field. But I have a rule that any day out of the office and in the field is a good day, and I hope to be out doing things and spending time with airmen.

I think my first opportunity to do that will be next week, and I have a number of engagements in Colorado next week.

Senator SULLIVAN. Great.

General GOLDFEIN. Senator, I will tell you my belief is that readiness and morale are inextricably linked. Where we have high readiness, we have high morale. If you walk the line today at Bagram and if you walk the line today at Kunshan in Korea, you are going to find high morale, because they have people, they have parts, they have what they need. They are flying at a high rate, and we keep them at a very high level of readiness. So their morale is very high.

There is a bill payer to get that level of readiness, and that is against all the bases now who have to contribute forces—personnel, supplies, equipment, and often aircraft—to be able to get that high level of readiness forward to fight tonight. Their readiness is at a lower level. That concerns me because that is the force we are going to rely on if a contingency kicks off.

So where you have lower levels of readiness, you are going to find low morale, because a pilot who does not fly, and air traffic controller who does not control, a maintainer who does not maintain, is not going to stay in this business, because we are not giving them the opportunity to be the best they can be in their business.

Senator SULLIVAN. Thank you.

Senator FISCHER. Thank you, Senator.

Senator Heinrich?

Senator HEINRICH. General Greaves, back to the issue of contracts for just a minute, I have spoken quite a bit in recent years about the significant amount of time that it takes to award contracts to small satellite businesses. In New Mexico, the delays have sometimes extended to one or more years before receiving approval. You and your team at SMC recently announced a space enterprise consortium that would use other transaction authorities to will help speed up that process.

How would you describe the industry response so far to the consortium RFI [Request for Information]? How will the consortium accelerate the solicitation-to-award timeline?

Finally, I just want to say thank you to you and Colonel Anttonen for your leadership on this issue.

Lt. Gen. GREAVES. Thank you, Senator.

The response of industry has been enthusiastic. By using the other transaction authority as we have done recently with our rocket propulsion system work, industry sees, as you mentioned, reduced timeline, increased responsiveness, and ability to execute their business case.

As far as timelines, the final coordination on the consortium direction is going through headquarters Air Force today. We expect to release it in 30 days and, by the end of July, to reward our first contract. That contract will be supporting development of tactics, techniques, and procedures in support of the space warfighting construct.

Senator HEINRICH. Thank you.

Senator FISCHER. Thank you, Senator.

Senator Cotton?

Senator COTTON. Thank you, Madam Chair. I apologize for my tardiness. I had presiding officer duty. It is very much a duty, not an honor, which blue suiters know, it is like staff duty when you are a lieutenant.

I understand, General Goldfein, that, in your opening statement, you spoke about the space corps, which is one of the approaches the GAO reported could resolve the fragmentation within the DOD, the separate space force. You said you do not support it at this time.

Could you elaborate a little bit on the reasons for that?

General GOLDFEIN. Yes, sir, because, right now, we are at this point in our history relative to the criticality of space that we are evolving from treating space as a domain that is relatively benign from which we report, sense, and monitor, to a domain that we have to fight in should a war extend or start—extend into space or start in space.

As we make this transition right now and we look at our operating construct and normalize joint warfighting, I would not recommend to this committee that we would go to a corps right now, because anything that separates space and makes it unique and different relative to all of the warfighting missions that we perform that are reliant on space, I do not believe that will move us in the right direction at this time.

Senator COTTON. Ms. Chaplain, would you care to provide any thoughts?

Ms. CHAPLAIN. Yes, I understand that point of view. In our report, we laid out options. We did not make a particular recommendation, because we think how it affects operations needs to be taken into account.

But I will say that the solutions tried to date that do not separate space as people think it should be separated have not worked very well. The reasons that people in these prior studies and even today believe that there needs to be some kind of segmentation is to protect the space budget, is to leverage expertise for the work force, and is to really clearly designate who is in charge. If it is not going to be that, it needs to be some kind of solution that does those things.

Senator COTTON. Thank you.

General Goldfein, you mentioned the difference between the benign environment that we are used to and increasing in a warfighting environment, which your joint statement from all the witnesses says right there on page 2.

What exactly is the risk that we face in space now, in layman's terms, so the ordinary American can understand it? Because I think most ordinary Americans do believe that space is a benign environment.

General GOLDFEIN. Well, again, to the average American who goes to an ATM [automated teller machine] and pulls money out of that ATM, the timing signal that ATM relies on comes from GPS satellites that are flown and managed by the United States Air Force. You want to take a look at not only how many activities are dependent—you can look at the transportation industry, whether you want to talk airlines or trains, it is dependent on that signal.

Just from a GPS constellation standpoint, I would argue that, globally, this is a constellation that we have to ensure that we are monitoring and protecting.

When we call it a joint warfighting domain, the idea here is that we actually now how to fight on land, at sea, in the air, and we have tried and true tactics, techniques, and procedures. Now is the time for us to apply those to the space domain so it becomes further integrated and normalized across how we fight.

That is why anything that actually talks about the business of separating and space in the same sentence I submit to you is moving us in the wrong direction. Anything that talks about integrating and normalizing space is moving us in the right direction.

Senator COTTON. The threat to normal Americans about their ATM machine sounds pretty dangerous. Who would do such a thing? What countries or what adversaries would be able to disable satellite constellations?

General GOLDFEIN. Without going into—I can get on your schedule for more of a classified——

Senator COTTON. No, no, I know who they are. I was just wondering if you wanted to say who they are.

General GOLDFEIN. Right now, in terms of who we are watching that is investing most in taking away our advantages in space, the two countries that are making the most investment in this area are China and Russia.

Senator COTTON. The asymmetry that we face is just inherent in our geopolitical situation? We sit here in the new world and we try to project power in the old world across the vast domains, and, therefore, we are inherently going to rely more on the space constellation than any old world power like Russia or China will?

Secretary Wilson, you look like you want to respond.

Secretary WILSON. Senator, let me take that one. It is not just our role in the world. It is that we are really good at it, and, hence, we have become heavily dependent on upon it. When it was uncontested, that was a nice place to be, but our adversaries know it, that we are heavily dependent upon it and very good at it, and, hence, they see the vulnerability.

In any conflict, space is going to be contested. We see the capabilities, and the folks can come up and brief you in a classified way, but it is also their declaratory policy. The Russians have publicly stated that this is part of their declaratory policy, to develop capabilities to deny us the use of space in any conflict.

Senator COTTON. Thank you all.

Senator FISCHER. Thank you, Senator.

Senator Cruz?

Senator CRUZ. Thank you, Madam Chairman.

Welcome, everyone. Thank you for being here testifying.

Secretary Wilson, congratulations on your confirmation and being sworn in. Thank you for your service once again.

Just a minute ago, you were visiting with Senator Cotton about the threats from Russia and China in space and, indeed, a couple of instances of potential conflict.

Russia's Kosmos-2499, a kamikaze satellite fashioned to destroy American satellites, and China's Shiyan, a grappling arm-equipped satellite that could remove United States assets from their orbit,

how serious do you estimate this threat is? What can be done to protect our assets from potential hostile activity in space?

General GOLDFEIN. Sir, I will tell you that we as the service responsible for flying all 12 constellations and 90 percent of the architecture, we take this very seriously. Without going into any kind of a classified discussion, I will just tell you that layering our defenses and ensuring that we truly understand and can characterize the threat, and then perhaps just as importantly as the constellations themselves, the command and control architecture that we are building in to first characterize and then be able to get the decision speed we need to respond quickly are all part of the space operating construct that we are working toward.

Then I would like to turn it over to General Raymond as well who is really the operational warfighter in this business, because a significant portion of our effort is actually also transitioning the space mission force into a force that has been focused primarily on monitoring and reporting and actually focused on fighting.

Senator CRUZ. General Raymond?

General RAYMOND. Thank you, Senator.

As I look at it, I have four imperatives, and in any warfighting domain, and I would characterize space as a warfighting domains just like air, land, and sea, in any of those warfighting domains, you have to have the ability to command and control forces in that domain. You have to have the ability to have space situational awareness or situational awareness in that domain. You have to have an architecture that is defendable. You have to have, as the chief just mentioned, professionally developed airmen that can fight and be joint warfighters.

Those four areas are where I am focused. We have made some pretty significant strides in battle management command-and-control. We are working hard in partnership with the National Reconnaissance Office in space situational awareness, and with other partners, including commercial space in developing ConOps on how we go about disaggregating that architecture and coming up with architecture. We work that very closely with national reconnaissance as well.

Then on the space professional development piece, we are making sure that our airmen have the ability to participate in exercises, wargames, go to the right training, the right schools, to be joined warfighters.

Senator CRUZ. What vulnerability would we have to a nuclear device in a satellite? What could be the potential harms to the Homeland if a nuclear device were detonated in orbit?

General RAYMOND. Senator, I would say that there is a spectrum of threats that we would be concerned about. They would go from anything from the low end of reversible jamming of communication satellites and GPS satellites, for example, up through directed energy, up through what we saw demonstrated in 2007 by the Chinese with the direct-ascent ASAT. Then I would put at the far end of that spectrum nuclear devices detonated in space, which would have very significant impacts across our constellations.

Lt. Gen. GREAVES. Senator, I would add that our most critical satellites with those capabilities, they have been designed to oper-

ate through the environment you just mentioned. In this forum, that is all I can say.

Senator CRUZ. What would the risks be of an EMP from a nuclear device detonated in orbit?

Lt. Gen. GREAVES. Senator, again, it would depend on the type of satellite systems. Our big data pipe, wide-band global satcom would be less protected than our most critical—satellites that are in the nuclear chain of command, those would be able to fight through that sort of environment.

Senator CRUZ. But we do have—it is correct that North Korea has satellites orbiting right now?

General RAYMOND. They have one satellite. I call it a piece of debris. It is not very useful. It is more of a statement that they have been able to put something in orbit, which is concerning. But I do not consider it a capability that provides them benefit.

Senator CRUZ. What are the most vital steps necessary to protect our assets in space, to prevent the space architecture from being taken down?

General RAYMOND. I think there are a couple things you have to do.

First of all, our plans are to make the capabilities that we have today more defensible. One thing you might do is add some maneuverability capability to allow it to be more agile. The other thing that we are working through is looking at an architecture perspective.

How might you disaggregate, diversify? We had good conversations earlier about the role of commercial space, the role of our allies. How do you build that architecture that puts you in a position day-to-day to be more defendable?

Senator CRUZ. Thank you.

Senator FISCHER. Thank you, Senator Cruz.

I thank you all for coming today and being able to present and discuss this very important topic with us.

Thank you all for your service to this country.

With that, we are adjourned.

[Whereupon, at 3:25 p.m., the subcommittee was adjourned.]

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR JAMES M. INHOFE

1. Senator INHOFE. Lt. Gen. Greaves, the Air Force's Evolved Expendable Launch Vehicle (EELV) program is the primary provider of launches for critical military and intelligence satellites. The Air Force has started introducing competition into the program, which for almost 10 years had only one company capable of providing launches. Has the Air Force determined whether the commercial and government launch markets can support at least two U.S. launch providers?

Lt. Gen. GREAVES. Yes, there is a stable enough commercial, National Security Space (NSS), and civil demand for launch services that the market will be capable of supporting more than one U.S. launch service provider. The Air Force has conducted research on various commercial launch market forecasts, including analyzing the Federal Aviation Administration (FAA) Commercial Space Transportation Committee (COMSTAC) forecasts and Year in Review reports. Our research indicates a stable competitive commercial market, with an average of 20–30 launches worldwide each year expected to be captured by U.S. launch providers. The forecast through 2023 shows an increase in the number of launches attributed to both NASA International Space Station re-supply missions and commercial telecommunications constellation replenishment. The Air Force is taking a conservative view on all

launch forecasts since, historically, launch vehicle and satellite program schedules are uncertain.

2. Senator INHOFE. Lt. Gen. Greaves, the EELV RFP requests Other Transactional Authority, or OTA, which is not traditionally used for multi-year billion dollar procurement contracts due to the lack of transparency and congressional oversight.

a) Lt. Gen. Greaves, who authorized this Other Transactional Authority?

b) Lt. Gen. Greaves, why was it needed?

c) Lt. Gen. Greaves, how does it ensure transparency with congress and specifically this committee?

Lt. Gen. GREAVES. Per 10 U.S.C. § 2371b(a)(2)(B)(1), Other Transaction Authority (OTA) for agreements over $250 million must be approved by USD(AT&L) with a 30-day period to provide notification to Congress. There were four OTA agreements awarded for Rocket Propulsion Systems (RPS). Mr. Frank Kendall approved the use of OTA for one of the RPS OTA agreements that was over $250 million on 11 January 2016. Per 10 U.S.C. § 2371b(a)(2)(A), the remaining OTA agreements were approved by SAF/AQ. The Air Force will pursue similar written determinations prior to the award of Launch Service Agreements.

Based on market research, the Air Force is implementing an acquisition strategy that invests in U.S. industry's launch system developments as the best way to be sure they not only meet commercial launch needs but also the stringent needs of National Security Space systems. This not only ends the use of the Atlas V launch vehicle, powered by the Russian RD–180 engine, but will lower the overall cost of launch and provide more innovation by leveraging competition. To implement this strategy, the Air Force carefully considered Federal Acquisition Regulation (FAR) type contracts, grants, and cooperative agreements, but these instruments were found not to be suitable. The use of OTA is appropriate because the Air Force, by investing in industry's commercial launch system solutions, can make sure that future launch services will meet National Security Space needs. The Air Force benefits by being able to procure launch services without having to pay the full cost of developing launch systems. The launch service providers benefit from the Air Force sharing the cost of developing systems that meet NSS requirements.

OTA agreements enable the Government to leverage industry investments. Industry will invest over $650 million in the existing RPS OTA agreements if all options are exercised, and significantly more industry investment is anticipated for the launch system prototype development efforts. In addition, the OTA agreements provide flexibility to execute varying deliverables and payment plans depending on each company's business structure and development maturity levels.

OTA agreements and the NASA equivalent, Commercial Space Act Agreements, were used to successfully develop all of the current *EELV*-class launch vehicles, including the Atlas V, Delta IV (EELV Development and Initial Launch Service Program), and Falcon 9 (Commercial model for NASA Public-Private Partnerships) launch vehicles.

The Air Force complied with the provision to notify Congress 30 days prior to the approval to use OTA for agreements over $250 million, per 10 U.S.C. § 2371b(a)(2)(B)(1). In addition, 10 U.S.C. § 2371b(c) requires that the Government Accountability Office have access to information under the Other Transaction Authority agreement.

The agreements require industry to provide data and completion evidence throughout development of the launch system so the Air Force has the insight into the development of the prototype and the data necessary to assure mission success in the future. The Air Force has provided and will continue to provide regular updates on the existing RPS OTA agreements to the relevant congressional authorization and appropriations committees since the RPS OTA agreements were awarded in January and February 2016.

ASSURED ACCESS TO SPACE

3. Senator INHOFE. Secretary Wilson, are the Falcon Heavy and Vulcan the only potential replacements for the Atlas V or are there other alternatives such as replacing the Atlas V engine?

Secretary WILSON. Industry is developing at least three alternative launch systems that will be able to replace the capability of the Delta IV and Atlas V. These are the SpaceX Falcon 9 and Falcon Heavy launch vehicles; the United Launch Alliance (ULA) Vulcan Launch System; and the Orbital ATK Next Generation Launcher (NGL). There could be others that eventually compete to meet Air Force launch

service needs. The Air Force's strategy is to invest in commercial launch systems so they meet National Security Space requirements to provide the Nation with assured access to space while transitioning off the Russian-built RD–180 engine and enabling a sustainable domestic launch industry. Shared investment with launch service providers is the best approach to building a domestic rocket propulsion system that is integrated into launch systems and can provide National Security Space launch services.

4. Senator INHOFE. Secretary Wilson, what is the impact on U.S. assured access to space if there are extensive delays with the development of the Falcon Heavy and/or Vulcan rockets?

Secretary WILSON. The Air Force needs assured access to space, and having at least two space launch vehicles (or families of space launch vehicles) capable of delivering National Security Space payloads, opens competition and options. As such, the Air Force plans to award up to three Launch Service Agreements (LSAs) to invest in industry's new and/or upgraded launch systems. Having three potential providers reduces the risk of a gap in assured access to space in case one company experiences development delays. To ensure access to Delta IV launch vehicle during development of a new launch system, the Air Force is procuring three additional sole-source Delta IV Heavy launch vehicles. These procurements, coupled with the ability to use up to eighteen additional RD–180 engines on Atlas V launch vehicles, are sufficient to provide assured access to space through the transition to new launch vehicles.

5. Senator INHOFE. Secretary Wilson, are there unique missions that only the Delta IV can perform? Is there another existing or planned platform that can do those missions when Delta IV is retired?

Secretary WILSON. The Delta IV has certified launch vehicle configurations capable of launching all three categories of missions; medium, intermediate, and heavy. Currently other certified launch vehicle options are only able to complete medium and intermediate missions. There are a few critical reconnaissance missions that currently require the Delta IV Heavy launch vehicle. The Air Force is procuring three additional Delta IV Heavy launch vehicles, all of which will launch by FY23. Industry is developing at least three alternative launch systems that will be able to replace the capability of the Delta IV and Atlas V. These are the SpaceX Falcon 9 and Falcon Heavy launch vehicles; the United Launch Alliance Vulcan Launch System; and the Orbital ATK Next Generation Launcher.

6. Senator INHOFE. Secretary Wilson, what is the full cost of each of the RD–180 replacement options and what is the cost to the government for each option?

Secretary WILSON. The full cost of RD–180 engine replacement options won't be known until launch service providers submit their launch service agreement proposals in the fourth quarter of 2017. In the meantime, the Air Force is investing in ongoing industry engine development via Rocket Propulsion System Other Transaction Authority agreements which were awarded in January-February 2016. The Air Force awarded: $536 million to Aerojet Rocketdyne for the development of the AR1 main stage engine; $176.9 million to Orbital ATK for development of the Common Boost Segment main stage, the Graphite Epoxy Motor 63XL strap-on booster, and an extendable nozzle for Blue Origin's BE–3U/EN upper stage engine; $61.4 million to SpaceX for development testing of the Raptor upper stage engine; and $201.6 million to United Launch Alliance for the development of the Vulcan/BE–4 main stage engine and the Advanced Cryogenic Evolved upper stage engine.

ROBOTIC SERVICING OF GEOSTATIONARY SATELLITES (RSGS) PROGRAM

7. Senator INHOFE. Secretary Wilson and General Goldfein, under DARPA's Robotic Servicing of Geostationary Satellites (RSGS) program, it is developing a spacecraft that will service satellites in the geosynchronous orbit.

a) Secretary Wilson and General Goldfein, what are the DOD requirements for servicing satellites in orbit?

b) Secretary Wilson and General Goldfein, if the RSGS capabilities are critical to national security, why would DARPA then hand the RSGS asset off to a sole commercial operator to contract with both the U.S. Government and the commercial marketplace vice providing the strategic asset to the Air Force, the intelligence community, or NASA to serve a national security purpose?

c) Secretary Wilson and General Goldfein, if the RSGS capabilities are critical to national security, why would DARPA then hand the RSGS asset off to a sole commercial operator to contract with both the U.S. Government and the commercial

marketplace vice providing the strategic asset to the Air Force, the intelligence community, or NASA to serve a national security purpose?

Secretary WILSON and General GOLDFEIN. DOD is examining technology approaches and concepts for future spacecraft that might benefit from on-orbit servicing. Currently, there are no validated requirements for servicing satellites in orbit but we anticipate that the RSGS technology demonstration will provide information needed to formulate approaches and support requirements. The experimental RSGS should provide data on the utility of on-orbit servicing that could be used to develop concepts for the future.

Future DOD needs for on-orbit servicing capabilities are highly speculative at present. RSGS will provide lessons learned on concepts of operations and acquisition strategy approaches that will be useful in determining an approach to fielding such a capability as warranted. DARPA can provide additional information on the appropriateness of their acquisition strategy for RSGS.

SPACE THREATS

8. Senator INHOFE. Secretary Wilson, there has been a tangible increase of threats to our space enterprise—vis-á-vis China, Russia, low-cost jamming and lasers that can disable our systems—that will also effect the warfighter that depends on these assets. Given the burgeoning investment in commercial capabilities, do you feel the Air Force and DOD is properly organized and equipped to counter these new threats with innovative technologies?

Secretary WILSON. As our potential adversaries recognize our dependence on space and the asymmetric advantage it provides, the space domain will become increasingly contested and must be viewed as a warfighting domain. The Air Force is engaged in a variety of initiatives to deal with this challenge. One of these is the establishment of a new Deputy Chief of Staff for Space Operations (AF/A11) and supporting staff. This new organization will ensure a dedicated focus of a Lieutenant General-led organization to concentrate on space operations, policy, guidance, requirements, integration and the synchronization required to strengthen the advocacy for and stewardship of Air Force missions and capabilities. The Air Force is also aggressively pursuing partnerships with the commercial space sector as well as interagency partners such as the NRO to take full advantage of synergies and interdependencies for operations and defense—a truly enterprise approach. Additionally, at the operational level units, we have evolved our space force posture and advanced our training to increase readiness though the implementation of the Space Mission Force. The Space Mission Force was specifically designed to improve our crewmembers' ability to recognize and react to adversary threats. While these are important steps, we must continue to adjust our posture to meet an increasingly contested space domain through additional investment in resilient systems, operations training, and organizational design.

SPACE LAUNCH

9. Senator INHOFE. Secretary Wilson and General Raymond, legacy launch providers operate under different FAR requirements than commercial entrants. What criteria is the Air Force is awarding launches and if there is more than one criterion, how are they weighted (such as price, reliability, schedule certainty and past performance)?

Secretary WILSON. Under EELV Phase 1A, all the providers must compete under the same criteria (same FAR requirements). The launch service competitions are a best value source selection. The EELV program office developed a baseline source selection approach where certification informs a rigorous responsibility determination prior to award. Certification status is a key consideration for the procuring contracting officer to determine a launch service provider as responsible/awardable.

In the construct of the launch service development Other Transaction Authority agreements, which will lead into Phase 2 procurement, the evaluation criteria will not be weighted but will be described with factors in an order of importance. Specific technical acceptance criteria based on mission-unique areas are used as discriminators. Schedule confidence is evaluated using schedule risk assessments as well as evaluating risk mitigation and open work closure plans. Past performance is an evaluation criteria for Phase 1A, but it will not be a criteria for Phase 2. Some critical missions have a low risk tolerance posture, which must be evaluated in source selection to obtain best value for the Government. Mission attributes justify additional risk evaluation (national importance, high dollar value, small constellations).

General RAYMOND. Under EELV Phase 1A, all the providers must compete under the same criteria (same FAR requirements). The launch service competitions are a best value source selection. The EELV program office developed a baseline source

selection approach where certification informs a rigorous responsibility determination prior to award. Certification status is a key consideration for the procuring contracting officer to determine a launch service provider as responsible/awardable.

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QUESTIONS SUBMITTED BY SENATOR DEB FISCHER

10. Senator FISCHER. General Raymond and Lt. Gen. Greaves, as you are aware, the Air Force awarded several GPS III feasibility assessment contracts last year. Can you provide an update on these contracts? Do the results of the Phase 1 assessment contracts help inform the GPS III acquisition strategy and requirements?

General RAYMOND. The GPS III Space Vehicles (SVs) 11+ Follow-on Program awarded Phase 1 in May 2016 and is nearing conclusion. Phase 1 was intended to verify whether viable GPS III follow-on production designs exist and to decrease technical risk for a Phase 2 follow-on production by allowing the Government to gain insight into contractors' production designs, navigation payload demonstration models, and manufacturing plans. Phase 1 results to-date indicate that competition may be viable. The results of Phase 1 will help inform the acquisition strategy and lower risk moving forward into Phase 2 of the Follow-On Production strategy.

Lt. Gen. GREAVES. The GPS III Space Vehicles (SVs) 11+ Follow-on Program awarded Phase 1 in May 2016 and is nearing conclusion. Phase 1 was intended to verify whether viable GPS III follow-on production designs exist and to decrease technical risk for a Phase 2 follow-on production by allowing the Government to gain insight into contractors' production designs, navigation payload demonstration models, and manufacturing plans. Phase 1 results to-date indicate that competition may be viable. The results of Phase 1 will help inform the acquisition strategy and lower risk moving forward into Phase 2 of the Follow-On Production strategy.

11. Senator FISCHER. General Goldfein and General Raymond, in general, what are your plans to address the growing threat to GPS from denial of service attacks?

General GOLDFEIN. Three forms of denial of service are an ongoing concern to GPS users: jamming, spoofing, and cyberattack. The first two are effects local to a theater of operations while the last has global reach. To address jamming and spoofing, the Air Force is introducing the new Military Code signal (M–Code) and modernized GPS user equipment, providing users with additional resiliency in GPS contested and denied environments. M–Code provides advanced signal design, processing and encryption techniques to defeat both jamming and spoofing. GPS satellite operators are also able to adapt the transmit power levels for M-code and legacy military signals to match threats, providing additional signal strength to overcome theater jamming effects.

To address cyberattack, the Air Force has completed a comprehensive evaluation on the cybersecurity posture of the existing GPS command and control system, Operational Control Segment (OCS). The Air Force is upgrading OCS to include network monitoring and intrusion detection to defend against denial of service and other cyber-attacks. OCS has built-in redundancy in its architecture at the system, subsystem, and component level, to include an entire alternate command and control ground station geographically separated from the primary command and control ground station. The follow-on Next Generation Operational Control System (OCX) is designed to operate in the modern threat environment and brings advanced cyber defense capabilities to the GPS enterprise. OCX will incorporate network monitoring and intrusion detection capability, in addition to a much more modern, robust security architecture.

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SPACE MODERNIZATION INITIATIVE

12. Senator FISCHER. Lt. Gen. Greaves, as you know, the Space Modernization Initiative (SMI) is intended to affordably evolve space-related technologies, concepts, and capabilities. Do you believe SMI funding should be used to support the insertion of new technologies into space systems, including those already under block-buy contracts, as a means to increase capabilities?

Lt. Gen. GREAVES. Yes and we are leveraging SMI funding to enhance the capabilities of the current space and ground systems. To the extent feasible, within cost and schedule targets, we will continue to invest in opportunities to insert new technologies to evolve the current program of record constellations and improve space segment performance, while reducing production timelines and associated production costs. SMI is also a key enabler to developing enhanced ground processing algorithms and data distribution capabilities to improve the quality and timeliness of the information we can provide the warfighter from on-orbit space assets. Furthermore, SMI funding is critical to maturing our abilities to deliver resilient, persistent capabilities in the face of attack across the space and ground segments.

QUESTIONS SUBMITTED BY SENATOR BILL NELSON

DEFENSE SPACE STAKEHOLDER ORGANIZATIONS

13. Senator NELSON. Secretary Wilson and Ms. Chaplin, in your testimony you refer to the GAO's identification of approximately 60 DOD space stakeholder organizations across DOD, the Executive Office of the President, the Intelligence Community, and civilian agencies, with 8 having acquisition management responsibilities, 11 having oversight responsibilities, and 6 involved in setting requirements. Secretary Wilson and Ms. Chaplin, how do you think we can effectively consolidate these stakeholders and make space acquisition more effective?

Secretary WILSON. There are a number of steps underway to consolidate stakeholder responsibility and improve the effectiveness of the space acquisition community. The White House is standing up a National Space Council led by the Vice President to give focus and attention to space matters across the government. USD/AT&L has returned Milestone Decision Authority for many key space programs back to the Services, as directed by the NDAA to reduce the number of people charged with acquisition oversight and empower the Service Acquisition Executives to make smart, timely decisions. The Air Force and Joint Staff are instituting a dedicated team to review and expedite space requirements. The Deputy Secretary of Defense recently approved the Policy Directive for the Principal Deputy Space Advisor, allowing me to lead collaboration across the National Security Space Community.

Ms. CHAPLIN. We have not recommended a particular solution but we have identified several options for consolidating stakeholders. These include combining military space functions into one agency; combining Air Force and NRO space acquisition functions into a space acquisition agency; and creating a new military department for the space domain—a Space Force. A fourth option, creating a Space Corps within the Air Force, has also been recently proposed. All of these options align with recommendations made by prior congressionally chartered commissions. For example, the Rumsfeld Commission in 2001 envisioned gradual changes starting in the short term with some realignments and dual hatting the Under Secretary of the Air Force as the Director of the NRO, then creating a Space Corps in the mid-term, and ulti-

mately creating a military department for space. A second commission in 2008, the Allard Commission, recommended establishing a single National Security Space Authority and National Security Space Organization which would pull in the National Reconnaissance Office, the Space and Missile Systems Center, Air Force Space Command space operations, as well as Army and Navy space organizations. The Allard Commission noted that such a structure would provide a foundation for growth and evolution of the organization into a corps or independent service as necessary to adapt to future events. All of these changes would likely involve significant short-term disruption to DOD's space organizational structure, roles, and responsibilities. Moreover, their consequences would extend far beyond the acquisition arena—the focus of our work with regard to space leadership. Careful consideration of any such changes is therefore essential for helping to ensure a better track record of providing warfighters with the capabilities they need on time and within costs. Experts we spoke with strongly suggested ensuring any change helps to (1) streamline reviews, (2) delegate more decision-making to lower levels, (3) increase unity of national security space decisions between DOD and the NRO, (4) achieve lasting change that cannot be quickly undone and to allow time for changes to work, and (5) provide sufficient acquisition, execution, and budget authority.

NATIONAL SPACE COUNCIL

14. Senator NELSON. Secretary Wilson and General Goldfein, to what extent might a revived National Space Council with authority for setting priorities for individual departments and agencies and with responsibility for strategic planning of space capabilities and operations be a positive change to help ensure effective interagency coordination of space efforts?

Secretary WILSON and General GOLDFEIN. A National Space Council provides an apex to the whole of government approach and can act as the focal point for national level space-related equities across the national security, civil, commercial and international portfolio. Elevating this function back into the White House also signifies its importance to the Nation.

DEFENSE SPACE ORGANIZATION

15. Senator NELSON. Last month, Air Force announced the establishment of a new three-star position of Air Force Deputy Chief of Staff for Space. General Goldfein and General Raymond, how will seemingly adding yet another layer of responsibility within the Air Force help to address the fragmented space leadership that already exists in the Department?

General GOLDFEIN. Last month, Air Force announced the establishment of a new three-star position of Air Force Deputy Chief of Staff for Space. General Goldfein and General Raymond, how will seemingly adding yet another layer of responsibility within the Air Force help to address the fragmented space leadership that already exists in the Department?

General RAYMOND. The A11 Deputy Chief of the Air Force for Space will not add another layer of responsibility within the Air Force. Rather, it will synchronize Air Force headquarters space activity as well as amplify and focus needed attention on national security space issues. The A11 will coordinate, synergize, and directly support space warfighting CONOPS development, exercise participation, wargaming, strategy development and planning in support of the combatant commands. A11 normalizes warfighting under the CSAF. It will also oversee force development for our enlisted, officer and civilian space professionals. And the A11 will champion for the requirements and resources necessary to field resilient capabilities to deter and prevail in any fight that extends to space.

16. Senator NELSON. Past studies such as the 2001 Space Commission and the 2008 Allard Commission have recommended far-reaching organizational changes to DOD's space enterprise, including centralizing space management. However, DOD has generally not made major changes. General Goldfein and General Raymond, what, if any, barriers do you see to making changes in DOD space and how can they be overcome?

General GOLDFEIN. The studies you reference recommended organizational change to fundamentally improve and assure space capabilities for the nation. DOD space has undergone significant change over the last several years, many due to recommendations from studies such as the Rumsfeld and Allard Commissions. For example, the department implemented the following from the 2001 Space Commission:

- Assigned command of AFSPC to 4-star other than CINCSPACE/CINCNORAD (end of tri-hatting AFSPC/NORAD/USSPACECOM)

- Ended the practice of assigning only flight rated officers to CINCSPACE/CINCNORAD
- Re-aligned headquarters to more efficiently organize, train and equip space operations and assign AFSPC responsibility for providing resources for acquisitions (Aligning SMC under AFSPC)
- Established the Air Force as Executive Agent for Space within DOD (later transitioned to PDSA role)

As we continue to normalize, integrate and elevate space as a warfighting domain, extraordinary organizational change—such as standing up of a Space Corps—is not warranted, and could be counterproductive. Rather, we must build on and accelerate ongoing efforts to fundamentally improve and assure space capabilities. These include streamlining acquisition and reducing bureaucratic oversight, empowering program managers, expediting requirements, exercising and war-gaming for a contested environment, synchronizing disparate voices and efforts and increasing collaboration across the national security space community. We should avoid efforts which create barriers to space integration into joint warfighting. Moving forward to normalize space for joint warfare is the direction I'd like to see for DOD space.

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SPACE ACQUISITION

17. Senator NELSON. In regard to space acquisitions, the DOD and NRO acquisition structures are different and we have heard praises of the NRO's structure. General Raymond and Lieutenant General Greaves, how can DOD adopt some elements of the NRO acquisition structure into its own structure?

General RAYMOND. Within the Air Force, the Program Manager reports to the Air Force Program Executive Officer for Space (AFPEO/SP), who in turn reports to the Air Force Service Acquisition Executive, who reports to the Milestone Decision Authority (MDA), the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)) at perhaps a Defense Acquisition Board (DAB) for Space Major Defense Acquisition Programs (MDAPs). The Air Force has two levels of oversight between the PM and the MDA. Within the NRO, the Director of the NRO (DNRO) serves as both the NRO Acquisition Executive (NAE) [similar to the SAE] and the Program Executive Officer (PEO). The Program Manager reports to the DNRO as the Agency Acquisition Executive, through the NRO established internal PEO structure. The DNRO, as the acquisition executive, then reports to the co-MDAs (Assistant Director of National Intelligence, Acquisition, Technology and Facilities (DNI(ATF)) and USD(AT&L)), for Major Systems Acquisition (MSA) wholly or majority funded by the National Intelligence Program at a National Intelligence Acquisition Board (NIAB) [similar to a DAB] for critical MSA acquisition decisions. Unlike the Air Force, NRO acquisitions, as in all IC (title 50) acquisitions, are governed by ICD 801, a tailored guidance patterned after DOD 5000. The NRO also establishes long term prime system integration relationships with their space vehi-

cle and payload providers. This reduces the number of contract actions, especially for non-competitive upgrades. The Air Force is exploring long-term relationships with prime contract providers with the expertise to quickly on-ramp capabilities in response to threats and mission capabilities. At the manpower level, the entire NRO is selectively manned. This is not the case for the Air Force space acquisition programs. Only a small portion is selectively manned. The Air Force is exploring opportunities to increase the space acquisition cadre in accordance with Air Force priorities and the space warfighting construct."

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QUESTIONS SUBMITTED BY SENATOR MARTIN HEINRICH

COMMERCIAL SATELLITE IMAGERY

18. Senator HEINRICH. General Raymond and Lt. Gen. Greaves, in the full committee we hear regularly from military leaders about the need for more ISR. In the past few years there has been a growth in U.S.-based commercial remote sensing satellite providers. These companies offer new capabilities for breadth of coverage and revisit rates for overhead satellite imagery, with new companies projected to significantly increase the total number of satellites operating in orbit providing persistent coverage. How can the Air Force benefit from access to this new imagery, and do you have any plans to leverage more commercial solutions to meet ISR requirements?

General RAYMOND and Lt. Gen. GREAVES. New imagery can be fused with existing and planned capabilities to provide warfighters with new or improved data to make decisions. For remote sensing capabilities such as missile warning and weather, we are looking to ingest multiple data sources into the Tools, Applications, and Processing Lab in Boulder, CO to support development of opportunities to fuse data and improve information available to warfighters; commercial data would be one source. We are at the initial stage of developing this architecture framework and have not contracted for commercial data sources at this time.

The Air Force is always seeking to leverage commercial capabilities to augment National Security Space missions. The Air Force routinely reaches out to industry to understand what can be used and purchased specifically for environmental monitoring. This is done through Broad Agency Announcement (BAA) and Requests for Information (RFI). The feedback we have received does indicate a budding market that in many cases still requires government subsidization to be financially viable. Recently awarded Broad Agency Announcement contracts aim to provide industry the opportunity to mature technology and solidify their commercial business case while meeting stringent military requirements.

KIRTLAND: A CENTER OF EXCELLENCE FOR SMALL SATELLITES

19. Senator HEINRICH. Secretary Wilson and General Goldfein, Kirtland Air Force Base in Albuquerque is a Center of Excellence for small satellites and hosts critical missions Operationally Responsive Space (ORS), the Air Force Research Laboratory Space Vehicles (AFRL/RV), as well as the Space and Missile Center's Advanced Systems and Development Director (SMC/AD), which all contribute to a more responsive and resilient space architecture. Given the increased competition in space from Russia and China, as well as other threats, how would you realistically define a space architecture that is responsive and resilient?

Secretary WILSON and General GOLDFEIN. A space architecture that is responsive and resilient requires a number of elements. Fundamentally, such an architecture must disincentive adversaries from attacking our space capabilities. To do so, we must be able to find, fix, target, track, engage against and assess threats. We need to field capabilities in a manner that reduces the adversaries' ability to target our space capabilities and moves from current constellations of a few precious assets to ones that devalue the capabilities of any single satellite or ground node. A responsive and resilient space architecture must include the ability to quickly regenerate capability and surge capacity in time of need. General Hyten, Commander U.S. Strategic Command, introduced the Space Enterprise Vision in 2016 when he was the Commander of Air Force Space Command. This document lays out an important framework for improving the resiliency of space based capabilities operating in a contested domain. Ensuring the ability to operate and utilize our space-based capabilities in a contested environment is an evolutionary process and the U.S. is engaged in a variety of initiatives to this end. Using the vital resources of the Operationally Response Space Office, Air Force Research Laboratory and Space and Missile Systems Center/Advanced Systems and Development Directorate, we are pursuing more rapid innovation and prototyping initiatives to "jump start" traditional acquisition processes by proving advanced technologies prior to engaging traditional acquisition processes. This will enable a streamlined acquisition approach, putting capability on orbit faster. In addition, Gen Raymond is transitioning the Space Enterprise Vision into an executable Space Warfighting Construct, driving strategies to increase resiliency such as disaggregation, distribution, and diversification which will change the satellite and constellation architectures to complicate an adversary's efforts to target our space capabilities in the future.

20. Senator HEINRICH. Secretary Wilson and General Goldfein, do you believe our space architecture is responsive and resilient enough to meet the threats we see today and on the horizon?

Secretary WILSON and General GOLDFEIN. Despite our ongoing initiatives to develop a more resilient space architecture for a contested domain, much more needs to be accomplished to ensure the United States space enterprise remains the strongest in the world. Our potential adversary's capabilities are continually evolving and we must continue to invest in the technologies and personnel necessary to maintain our space superiority in this increasingly contested domain. The fiscal year 2018 President's Budget begins to address that reality, but more future investment is required in the face of advanced, demonstrated, and evolving threats.

21. Senator HEINRICH. Secretary Wilson and General Goldfein, how are you leveraging commercial-off-the-shelf technologies and satellites for some of our capability gaps in space?

Secretary WILSON and General GOLDFEIN. Harnessing commercial technologies and systems is a key element of our strategy. The strength of the commercial space economy allows us to leverage many of their capabilities, data and services just like we leverage commercial infrastructure in air, land and sea. Our approach includes the already widespread use of commercial SATCOM but also commercial space situational awareness data, commercial teleports for communicating with military satellites, hosting payloads on commercial systems, and a myriad of other capabilities.

22. Senator HEINRICH. Secretary Wilson and General Goldfein, what is needed from Congress, or do you need from industry, to make our space architecture truly responsive and resilient?

Secretary WILSON and General GOLDFEIN. In order to ensure our space architecture is truly responsive and resilient during conflicts that extend into space, the U.S. Air Force will require significant future investment in the personnel that make up our space forces and the advanced technology required of space based capabilities. This investment is necessary to ensure operations in a contested environment with evolving threats. One key component to ensure our personnel are ready to op-

erate in a contested space domain is providing them the training infrastructure, to include training ranges, that provide realistic training and development of TTPs to counter the evolving threat. We also count on our industry partners to develop and manufacture much of the technology we rely on for our space based capabilities. However, we can only fund our industry partners within budgetary constraints.

OPERATIONALLY RESPONSIVE SPACE

23. Senator HEINRICH. Secretary Wilson and General Goldfein, the Department initiated the ORS office to take a new approach toward risk and mission assurance for rapidly deploying capabilities that are good enough to satisfy warfighter needs across the entire spectrum of operations, from peacetime through conflict. What plans does the Air Force have for the ORS office and what assurances can the Air Force provide for its support of the program in the future?

Secretary WILSON and General GOLDFEIN. The Air Force plans to use the rapid acquisition authorities granted to the Operationally Responsive Space (ORS) program for rapid prototyping and fielding of residual operational capability. The USAF will exercise these authorities to the fullest extent possible, creating strategies that remove potential obstacles and adapt current practices while crafting new and improved approaches within these authorities. We must take immediate action to change the culture in our acquisition organizations to focus on speed, innovation, and risk acceptance.

SMALL SATELLITE CAPABILITIES

24. Senator HEINRICH. General Raymond and Lt. Gen. Greaves, we are seeing a revolution in the use of small satellites, particularly for remote sensing but for other needs as well. Soon we are going to see a similar revolution in small satellite launch. How is the Air Force positioning itself to take advantage of these capabilities?

General RAYMOND. The revolution in small satellite development and application is being driven by technology academia and the commercial sector. The Air Force is not the change agent, merely the benefactor. Similar to advancements in personal cell phones, the Air Force must adapt to new capabilities, paradigms, processes and vulnerabilities. Originally, cell phone cameras were primitive fixed focal length devices, and have evolved to higher resolutions, flash-equipped, zoom capable, still-image and video recording devices. Small satellites, by their sheer nature, have limitations in range, power and computing capability, but their sheer numbers can create redundancy and resiliency. Integrated architectures, data fusion and synthesis will be the enablers that unlock the power of smaller space sensors, transmitters and points of presence. Air Force Space Command in concert with Air Force Research Laboratory are looking to further take advantage of commercial and Government investments in these technology areas. Additionally, the shorter development and acquisition cycles of small satellites (and non-traditional mission partners) provides the ability to rapidly prototype and deploy future on-orbit capabilities to counter emerging threats. Finally, streamlining acquisition processes and timelines will enable quicker capability into operations. To that end, SMC is currently organizing a Space Consortium and to attract New Space and non-traditional mission partners.

Lt. Gen. GREAVES. The revolution in small satellite development and application is being driven by technology, academia and the commercial sector. The Air Force is not the change agent, merely the benefactor. Similar to advancements in personal cell phones, the Air Force must adapt to new capabilities, paradigms, processes and vulnerabilities. Originally, cell phone cameras were primitive fixed focal length devices, and have evolved to higher resolutions, flash-equipped, zoom-capable, still-image and video recording devices. Small satellites, by their very nature, have limitations in range, power and computing capability, but their sheer numbers can create redundancy and resiliency. Integrated architectures, data fusion and synthesis will be the enablers that unlock the power of smaller space sensors, transmitters and points of presence. Air Force Space Command in concert with Air Force Research Laboratory are looking to further take advantage of commercial and Government investments in these technology areas. Additionally, the shorter development and acquisition cycles of small satellites (and non-traditional mission partners) provides the ability to rapidly prototype and deploy future on-orbit capabilities to counter emerging threats. Finally, streamlining acquisition processes and timelines will enable quicker capability into operations. To that end, SMC is currently organizing a Space Consortium using Other Transaction Authorities to utilize some of these authorities for prototyping activities and to attract New Space and non-traditional mission partners.

25. Senator HEINRICH. General Raymond and Lt. Gen. Greaves, can you explain how they fit into the Air Force's needs for responsiveness and resiliency?

General RAYMOND. The revolution in small satellite development and application is being driven by technology, academia and the commercial sector. The Air Force is not the change agent, merely the benefactor. Similar to advancements in personal cell phones, the Air Force must adapt to new capabilities, paradigms, processes and vulnerabilities. Originally, cell phone cameras were primitive fixed focal length devices, and have evolved to higher resolutions, flash-equipped, zoom-capable, still-image and video recording devices. Small satellites, by their very nature, have limitations in range, power and computing capability, but their sheer numbers can create redundancy and resiliency. Integrated architectures, data fusion and synthesis will be the enablers that unlock the power of smaller space sensors, transmitters and points of presence. Air Force Space Command in concert with Air Force Research Laboratory are looking to further take advantage of commercial and Government investments in these technology areas. Additionally, the shorter development and acquisition cycles of small satellites (and non-traditional mission partners) provides the ability to rapidly prototype and deploy future on-orbit capabilities to counter emerging threats. Finally, streamlining acquisition processes and timelines will enable quicker capability into operations. To that end, SMC is currently organizing a Space Consortium using Other Transaction Authorities to utilize some of these authorities for prototyping activities and to attract New Space and non-traditional mission partners.

Lt. Gen. GREAVES. The Foundation of our current space capabilities has been a small portfolio of highly capable, exquisite, high-value platforms. Space is no longer the benign environment of just a decade ago and we must be prepared to operate through this contested and congested environment. Resilient and alternative space capabilities are no longer a luxury, but a necessity. By utilizing small satellites for selective missions, they can play a significant role in maintaining our space capabilities. These can be launched quickly to enhance our resiliency posture and benefit our primary mission areas. Small satellites used in crowded, networked constellations with numerous ground entry points present a highly resilient and difficult target set. Air Force Space Command is evaluating all of these opportunities to ensure capabilities to the warfighter.

SPACE ENTERPRISE VISION

26. Senator HEINRICH. General Raymond and Secretary Wilson, the Space Enterprise Vision identifies the need to transform our nation's approach to space over the course of more than a decade. But, what are we doing in the short term?

General RAYMOND. The Air Force has embarked on the Space Warfighting Construct to provide "meat on the bones" of the Space Enterprise Vision as rapidly as possible. Based on the Space Enterprise Vision, the Space Warfighting Construct includes a set of Concepts of Operations, normalizing how we operate using proven methods of joint warfighting. The Space Mission Force is the human capital portion of the Space Warfighting Construct and shifts the way we train space forces enabling their ability to operate in a contested space environment—much the same way we train our other combat forces. The Space Warfighting Construct also includes efforts toward developing a more resilient space and ground system architecture as well as demanding enterprise agility in order to ensure we remain responsive to changing threats. We have improved our space situational awareness capabilities to find, fix, target, and track. Finally, the Construct seeks to expand DOD, Intelligence Community and Civil partnerships in order to achieve our national security objectives. Our strong partnership with the NRO is a case in point.

Secretary WILSON. The Air Force has embarked on the Space Warfighting Construct to provide "meat on the bones" of the Space Enterprise Vision as rapidly as possible. Based on the Space Enterprise Vision, the Space Warfighting Construct includes a set of Concepts of Operations, normalizing how we operate using proven methods of joint warfighting. The Space Mission Force is the human capital portion of the Space Warfighting Construct and shifts the way we train space forces enabling their ability to operate in a contested space environment—much the same way we train our other combat forces. The Space Warfighting Construct also includes efforts toward developing a more resilient space and ground system architecture as well as demanding enterprise agility in order to ensure we remain responsive to changing threats. We have improved our space situational awareness capabilities to find, fix, target, track. Finally, the Construct seeks to expand DOD, Intelligence Community and Civil partnerships in order to achieve our national security objectives. Our strong partnership with the NRO is a case in point.

27. Senator HEINRICH. General Raymond and Secretary Wilson, what can we do right now to start that transformation?

General RAYMOND. We are already moving out on our transformation strategy. We've stood up the National Space Defense Center where we are working with the NRO to develop the Concepts of Operations that inform the changes we need to make to be successful against any potential adversary. We have added and continue to add significant new ground and space-based Space Situational Awareness capabilities. We have already agreed to collaborate on a program with the NRO that further enhances our space situational awareness. We are combining the expertise and authorities of Air Force Research Laboratory, the Rapid Capabilities Office and Space and Missile Systems Center to put in place the command and control we will need to orchestrate multi-domain operations. As part of the FY19 budget planning process we are defining the future state for our missile warning and protected SATCOM capabilities. We are also putting in place the ability for more robust prototyping to test new concepts and new capabilities and to give our Airmen the opportunity to train like we need them to fight. We're fielding new GPS satellites that will provide a more powerful and jam resistant signal and are developing the modernized GPS receivers for our warfighters.

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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2018 AND THE FUTURE YEARS DEFENSE PROGRAM

WEDNESDAY, MAY 24, 2017

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

THE DEPARTMENT OF ENERGY'S ATOMIC ENERGY DEFENSE ACTIVITIES AND PROGRAMS

The subcommittee met, pursuant to notice, at 2:30 p.m. in Room SD–G50, Dirksen Senate Office Building, Senator Deb Fischer (chairman) presiding.

Committee members present: Senators Fischer, Inhofe, Sullivan, Donnelly, Heinrich, Warren, and Peters.

OPENING STATEMENT OF SENATOR DEB FISCHER

Senator FISCHER. Good afternoon, everyone. The hearing will come to order.

The subcommittee meets today to receive testimony on the Department of Energy's atomic energy defense activities, and I thank our distinguished panel before us for their service and for agreeing to appear before us.

Of the missions represented here today, there is no higher priority than maintaining the safety and the reliability of our nuclear stockpile.

General Klotz, we look forward to hearing an update from you on the life extension programs and major alterations that NNSA [National Nuclear Security Administration] is currently performing, in particular the B61–12, which will be carried by our nuclear-certified aircraft, and the W80–4, which will be the warhead for the long-range standoff weapon, another system that we need in order to maintain our deterrence.

Modernizing the infrastructure and scientific capabilities that make up NNSA's nuclear complex is also vitally important. As General Hyten testified earlier this year, in concert with our delivery platforms, our nuclear weapons stockpile and the unique facilities that sustain the stockpile must be modernized to ensure our deterrent remains effective and credible.

I remain concerned that we are not making enough progress in this area. Warheads continue to age, the geo-political landscape

continues to change, and we must ensure that progress toward a responsive nuclear enterprise is keeping pace.

Admiral Caldwell and Ms. Cange, we will also be interested in hearing updates from each of you on the programs within your purview. Additionally, we would appreciate your assessment on whether the newly-released budget adequately meets the needs of your missions and where it accepts risk.

With that, I recognize the ranking member, Senator Donnelly, for any opening remarks he'd like to make.

Senator Donnelly?

STATEMENT OF SENATOR JOE DONNELLY

Senator DONNELLY. Thank you, Madam Chair.

This subcommittee has a strong history of bipartisan support for modernization of our nuclear deterrent in which the National Nuclear Security Administration plays a central role. I want to thank today's witnesses for joining us to testify on the fiscal year 2018 budget request for defense programs at the Department of Energy.

Administrator Klotz, I am glad you have stayed on at the Department of Energy through this transition. With so many important modernization activities underway, it's essential these operations move forward with minimal disruption.

I want to hear from you what the National Nuclear Security Administration is doing to ensure our warhead life extension programs stay on track and that your organization is heeding lessons learned and best practices gathered from the many reports on your operations over the past several years.

Admiral Caldwell, it's good to see you again. Thanks for making the time to come down to Newport News last month for the christening of the future USS *Indiana,* a submarine that is close to the heart of every Hoosier. It was good to have you there. I look forward to hearing from you about progress on the *Columbia*-class submarine and the ongoing infrastructure modernization across the naval reactors complex.

Ms. Cange, welcome. The Environmental Management Program undertakes some of the Energy Department's most complex work. We'll want to hear about the status of operations at the Waste Isolation Pilot Plant and the storage tunnel collapse at Hanford, among other things.

Mr. Trimble, as always, we're grateful to you and your staff for the excellent work you do in support of this subcommittee. I look forward to your testimony.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator.

Before we begin with our statements from the panel, I would like to announce that we have two votes today at 3:00. When there's about two minutes left in the first vote, the committee will recess until after we take our second vote, and then we will be back.

With that, I would ask for our panelists to give us their opening statements, knowing that your full statement will be included in the record.

General Klotz, welcome.

STATEMENT OF HONORABLE FRANK G. KLOTZ, UNDER SECRETARY FOR NUCLEAR SECURITY, DEPARTMENT OF ENERGY

Secretary KLOTZ. Thank you, Chairwoman Fischer, Ranking Member Donnelly, and Senator Inhofe, and other members of the subcommittee who will show up. Thank you for the opportunity to present the President's fiscal year 2018 budget request for the Department of Energy's National Nuclear Security Administration.

We value this committee's strong support for the nuclear security mission and for the people and the organizations that are responsible for executing it.

Our budget request, which comprises approximately half of DOE's [Department of Energy] budget, is $13.9 billion. This represents an increase of $1 billion, or 7.8 percent, over the fiscal year 2017 omnibus level.

This budget request demonstrates the administration's strong support of NNSA's diverse missions. As you will recall, those are maintaining the safety, security, reliability, and effectiveness of the nuclear weapons stockpile; reducing the threat of nuclear proliferation and nuclear terrorism at home and around the world; and providing naval nuclear propulsion to the U.S. Navy's fleet of aircraft carriers and submarines.

The budget materials we have provided describe NNSA's major accomplishments in fiscal year 2016, as well as the underlying rationale for our budget proposal for the coming fiscal year. Let me just briefly highlight a few of the points that are explained in greater detail in our written submission.

This budget request is vital to ensuring that U.S. nuclear forces are modern, robust, flexible, resilient, ready, and appropriately tailored to 21st Century threats and to reassure our allies. NNSA's fiscal year 2018 budget request for the weapons activity appropriation is $10.2 billion, an increase of nearly $1 billion, or 10.8 percent over the fiscal year 2017 omnibus level. This increase is needed to both meet our current life extension program commitments and to modernize our research and production infrastructure so we are positioned to address future requirements and future challenges.

The budget request will enable NNSA to meet its program objectives, including beginning construction of the main process building and the salvage and accountability building at the Y–12 uranium processing facility in Oak Ridge, Tennessee; and restoring the Nation's capability to manufacture plutonium pits on the timeline required to meet future stockpile needs.

The fiscal year 2018 budget request also includes $1.8 billion for the Defense Nuclear Non-Proliferation Account, which is consistent with the enacted funding level for fiscal year 2017. This appropriation continues NNSA's critical and far-reaching mission to prevent, counter, and respond to nuclear threats.

The request for our third appropriation, the Naval Reactors Program, is $1.48 billion; and, of course, it's a delight to be here with Admiral Caldwell, who can discuss the details of that appropriation account. It represents an increase of $60 million, or 4.2 percent above the fiscal year 2017 omnibus level. Not only does the requested funding support today's operational fleet, it also enables Naval Reactors to deliver tomorrow's fleet by funding three na-

tional priority projects: developing the *Columbia*-class reactor plant, as you indicated; refueling a research and training reactor in New York; and building a new spent fuel handling facility in Idaho.

As NNSA executes our three vital missions, we are mindful of our obligation to continually improve our business practices and to be responsible stewards of the resources that Congress and the American people have entrusted to us. NNSA is committed to encouraging competition and streamlining its major acquisition processes. Recent competitions for management and operations contracts have generated extraordinary interest from industry and academic institutions, validating the acquisition and program management improvements that we have instituted over the last five years.

Finally, our budget request for Federal salaries and expenses is $418 million, an increase of $31 million, or 8.1 percent over the fiscal year 2017 omnibus level. This request supports recruiting, training, and retaining the highly skilled Federal workforce essential to achieving success in technically complex, 21st Century national security missions.

Since 2010, NNSA's program funding has increased 28 percent. However, at the same time, our staffing has decreased 17 percent. The fiscal year 2018 budget request supports a modest increase of 25 full-time equivalent employees over the current cap of 1,690 full-time equivalent employees. Phase I of a study by the Office of Personnel Management confirms that NNSA needs additional Federal staff.

In closing, our fiscal year 2018 budget request reflects our motto: "Mission first, people always." It accounts for the significant tempo of operations at NNSA, which in many ways has reached a level unseen since the end of the Cold War. It includes long overdue investments to repair and replace aging infrastructure at our national laboratories and our production plants, and it provides modern and more efficient workspace for our highly trained scientific, engineering, and professional workforce.

Again, thank you for the opportunity to appear before this subcommittee today.

[The prepared statement of Secretary Klotz follows:]

PREPARED STATEMENT BY SECRETARY FRANK G. KLOTZ

Chairwoman Fischer, Ranking Member Donnelly, and Members of the Subcommittee, thank you for the opportunity to present the President's fiscal year (FY) 2018 budget request for the Department of Energy's (DOE) National Nuclear Security Administration (NNSA). The Committee's strong support for the nuclear security mission and for the people and organizations that are responsible for executing it is deeply appreciated.

The President's fiscal year 2018 budget request for NNSA is $13.9 billion, an increase of $1.0 billion, or 7.8 percent over the fiscal year 2017 Omnibus level. The request represents approximately 50 percent of DOE's total budget and 68 percent of DOE's 050 budget.

NNSA's diverse missions are critical to the national security of the United States: maintaining the safety, security, reliability, and effectiveness of the nuclear weapons stockpile; reducing the threat of nuclear proliferation and nuclear terrorism around the world; and providing nuclear propulsion for the U.S. Navy's fleet of aircraft carriers and submarines. This budget request demonstrates the Administration's strong support for NNSA and is vital to ensuring that U.S. nuclear forces are

modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st Century threats and reassure America's allies.

NNSA's activities are accomplished through the expertise, innovative spirit, and hard work of both its federal and its Management and Operating (M&O) contractor employees. NNSA must continue to support these highly-talented, dedicated men and women as they carry out complex and challenging responsibilities. In particular, it is imperative that NNSA modernize its scientific, technical, and engineering capabilities, as well as its infrastructure, in order to provide a safe, modern, and more efficient workspace for its workforce. In doing so, NNSA is mindful of its obligation to continually improve its business practices and to be responsible stewards of the resources that Congress and the American people have entrusted to the agency.

The fiscal year 2018 budget request also reflects the close working partnership between NNSA, the Department of Defense (DOD), the Department of Homeland Security (DHS), the State Department, the Intelligence Community, and other federal departments and agencies. NNSA works closely with DOD to meet military requirements, support the Nation's nuclear deterrent, and modernize the nuclear security enterprise. NNSA also collaborates with a range of federal agencies to prevent, counter, and respond to nuclear proliferation and nuclear terrorism.

WEAPONS ACTIVITIES APPROPRIATION

For the Weapons Activities account, the fiscal year 2018 budget request is $10.2 billion, an increase of nearly $1 billion, or 10.8 percent over the fiscal year 2017 Omnibus level. Programs funded in this account support the Nation's current and future defense posture and its attendant nationwide infrastructure of science, technology, and engineering capabilities. Weapons Activities provide for the maintenance and refurbishment of nuclear weapons to maintain their safety, security, and reliability; investments in scientific, engineering, and manufacturing capabilities to certify the enduring nuclear weapons stockpile; and the fabrication of nuclear weapon components. Weapons Activities also includes investments to make the NNSA nuclear complex more cost effective and more responsive to unanticipated challenges or emerging threats.

Maintaining the Stockpile

This year, the work of the science-based Stockpile Stewardship Program (SSP) allowed the Secretaries of Energy and Defense to certify to the President for the 21st consecutive year that the U.S. nuclear weapons stockpile remains safe, secure, and reliable without the need for nuclear explosive testing. This remarkable scientific achievement is made possible each year by investments in state-of-the-art diagnostic tools, high performance computing platforms, modern facilities, and most importantly by NNSA's world-class scientists, engineers, and technicians.

For *Directed Stockpile Work (DSW),* the fiscal year 2018 budget request is $4.0 billion, an increase of $669 million, or 20.2 percent over the fiscal year 2017 Omnibus level.

The major warhead Life Extension Programs (LEPs) are a fundamental part of this account:

- *W76–1 LEP:* The $224 million requested for the W76–1 LEP directly supports the sea-based leg of the nuclear triad and will keep the LEP on schedule and on budget to complete production in fiscal year 2019.
- *B61–12 LEP:* NNSA continues to make progress on the B61–12 LEP, which will consolidate four variants of the B61 gravity bomb and improve the safety and security of the oldest weapon system in the U.S. nuclear arsenal. In June 2016, NNSA authorized the program to transition into the Production Engineering Phase (Phase 6.4). With the $788.6 million requested, NNSA will remain on schedule to deliver the First Production Unit (FPU) of the B61–12 in fiscal year 2020. NNSA is responsible for refurbishing the nuclear explosives package and updating the electronics for this weapon, while the Air Force will provide the tail kit assembly under a separate acquisition program. When fielded, the B61–12 gravity bomb will support both Air Force long-range nuclear-capable bombers and dual-capable fighter aircraft, bolstering central deterrence for the United States while also providing extended deterrence to America's allies and partners.
- *W88 Alteration (Alt) 370 Program:* In February 2017, NNSA began the Production Engineering Phase (Phase 6.4) for the W88 Alt 370 Program, including conventional high explosives refresh activities. The budget request for this program, which also supports the sea-based leg of the nuclear triad, includes $332 million in fiscal year 2018, an increase of $51 million, or 18.2 percent over the

fiscal year 2017 Omnibus level, to support the scheduled FPU in fiscal year 2020.

- *W80–4 LEP:* The fiscal year 2018 budget request is $399 million, an increase of $179 million, or 81.2 percent over the fiscal year 2017 Omnibus level. This funding supports a significant increase in program activity through the Design Definition and Cost Study Phase (Phase 6.2A), driving toward a fiscal year 2025 FPU in support of the Air Force's Long Range Stand-Off (LRSO) cruise missile program.

Also within DSW, the fiscal year 2018 budget request includes $1.5 billion for Stockpile Systems and Stockpile Services. These programs sustain the stockpile in accordance with the Nuclear Weapon Stockpile Plan by producing and replacing limited-life components such as neutron generators and gas transfer systems; conducting maintenance, surveillance, and evaluations to assess weapon reliability; detecting and anticipating potential weapon issues; and compiling and analyzing information during the Annual Assessment process.

NNSA continues to make progress on the Joint Technology Demonstrator (JTD) program, a strategic collaboration between the United States and the United Kingdom under the Mutual Defense Agreement. This program is intended to reduce technological risk and provide relevant data for future program activities. JTD's focus is on technologies and process improvements that can improve weapon affordability and enhance weapon safety and security.

Within DSW, the fiscal year 2018 budget request also includes $695 million for Strategic Materials. This funding is necessary to maintain NNSA's ability to produce the nuclear and other strategic materials associated with nuclear weapons as well as refurbish and manufacture components made from these materials. The program includes Uranium Sustainment, Plutonium Sustainment, Tritium Sustainment, Domestic Uranium Enrichment (DUE), and other strategic materials, such as lithium.

Funding for Uranium Sustainment will permit operations with enriched uranium in Building 9212, a Manhattan Project-era production facility at the Y–12 National Security Complex in Oak Ridge, Tennessee, to end in fiscal year 2025, and allow the bulk of this obsolete building to shut down.

Plutonium Sustainment funds the replacement and refurbishment of equipment and critical skills needed to meet the pit production requirements. Increases are included to fabricate several W87 developmental pits. Investments to replace pit production equipment which has reached the end of its useful life and install equipment to increase production capacity are also continued.

Tritium Sustainment ensures the Nation's capacity to provide the tritium for national security requirements by irradiating Tritium Producing Burnable Absorber Rods in designated Tennessee Valley Authority nuclear power plants and by recovering and recycling tritium from gas transfer systems returned from the stockpile.

The DUE program continues its efforts to ensure that NNSA has the necessary supplies of enriched uranium for a variety of national security needs. Funding increases are included in this year's request to begin down-blending available stocks of unobligated highly enriched uranium (HEU) for use in tritium production, which delays the need date for a DUE capability until at least 2038–2041.

The fiscal year 2018 budget request also includes $52 million for Weapons Dismantlement and Disposition to allow NNSA to remain on track with the goal of dismantling all weapons retired prior to fiscal year 2009 by the end of fiscal year 2022.

For *Research, Development, Test, and Evaluation (RDT&E),* the fiscal year 2018 budget request is $2 billion, an increase of $186 million or 10.1 percent over the fiscal year 2017 Omnibus level.

Increases for the Science Program ($487.5 million, an increase of $51 million) provide additional funding for the Advanced Sources and Detectors Major Item of Equipment in support of the Enhanced Capabilities for Subcritical Experiments (ECSE) effort.

The Engineering Program ($193.1 million, an increase of $61 million) sustains NNSA's trusted microsystems capability and further develops the Stockpile Responsiveness Program (SRP). NNSA is requesting $40 million in fiscal year 2018 for SRP to identify, sustain, enhance, integrate, and continually exercise the capabilities required to conceptualize, study, design, develop, engineer, certify, produce, and deploy nuclear weapons. These activities are necessary to ensure the U.S. nuclear deterrent remains safe, secure, reliable, credible, and responsive. The funding will support the creation of design study teams to explore responsiveness concepts as well as development of capabilities for accelerating the qualification and production cycle.

The Inertial Confinement Fusion Ignition and High Yield Program has spearheaded ongoing improvements in management and operational efficiencies at NNSA's major high energy density (HED) facilities, including the National Ignition Facility (NIF) at LLNL in California, the Z–Machine at Sandia National Laboratories in New Mexico, and the OMEGA laser facility at the University of Rochester in New York. In fiscal year 2016, NIF exceeded the goal of 400 data-acquiring shots (417), more than double the number of shots executed in fiscal year 2014 (191) in support of the SSP. The improved shot rates have accelerated progress towards the achievement and application of multi-megajoule fusion yields, investigating material behaviors in conditions presently inaccessible via other experimental techniques, and improving the predictive capability of NNSA's science and engineering models in high-pressure, high-energy, high-density regimes.

The RDT&E request for fiscal year 2018 includes $734 million for the Advanced Simulation and Computing (ASC) Program. NNSA is taking major steps in high performance computing (HPC) to deliver on its missions by deploying increasingly powerful computational capabilities to both Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL). In the summer of 2017—Trinity—NNSA's next generation high performance computer, will become fully available for classified use at LANL. This computer will be about 30 times more powerful than the Cielo super computer it is replacing. The Sierra HPC system will be deployed at LLNL starting this year; it is projected to provide four to six times the sustained performance of LLNL's current HPC system, Sequoia.

The RDT&E request also increases NNSA's contribution to the Exascale Computing Initiative (ECI) from $95 million in fiscal year 2017 to $161 million in the fiscal year 2018 request. The ECI is a collaboration with DOE's Office of Science to develop the technology needed for exascale-class high performance computing. The increased funding will provide for NNSA-specific application development, and improve software and hardware technologies for exascale computing in order to meet NNSA's needs for future assessments, LEPs, and stockpile stewardship. Specifically, exascale computing will provide capabilities to improve weapon performance simulation tools and techniques; evaluate the safety, security, and effectiveness of the current stockpile; and provide support to certify potential advanced surety features for the future stockpile.

NNSA's *Secure Transportation Asset (STA)* program provides safe, secure movement of nuclear weapons, special nuclear material (SNM), and weapon components to meet projected DOE, DOD, and other customer requirements. The Office of Secure Transportation (OST) has an elite workforce performing sensitive and demanding work; OST agents are among the most highly trained national security personnel operating within the United States. Since fiscal year 2012, STA has repeatedly been funded below the Administration's budget requests. This trend increases risks and possible production delays to the Mobile Guardian Transporter (MGT) and adversely affects OST's ability to recruit and retain agents. The fiscal year 2018 budget request of $325.1 million includes an increase of $76 million or 30.6 percent over the fiscal year 2017 Omnibus level to continue asset modernization and workforce capability initiatives. These initiatives include: (1) restoration of federal agent strength levels to meet the goal of 370 agents; (2) the Safeguards Transporter (SGT) Risk Reduction Initiatives to manage the SGT beyond its design life; (3) procurement of long-lead parts and materials for the two full scale MGT prototype systems; and (4) deferred facilities maintenance and minor construction projects at multiple sites.

Improving Safety, Operations, and Infrastructure

NNSA's ability to achieve its vital national security missions is dependent upon safe and reliable infrastructure. If not appropriately addressed, the age and condition of NNSA's infrastructure will put NNSA's missions, the safety of its workers, the public, and the environment at risk. More than half of NNSA's facilities are over 40 years old, and roughly 30 percent date back to the Manhattan Project era. The fiscal year 2018 budget request for Infrastructure and Operations is $2.8 billion, a decrease of $5 million, or 0.2 percent below the fiscal year 2017 Omnibus level. The request actually represents an increase of $195 million (7.5 percent) after adjusting for the one-time $200 million Bannister Federal Complex project funded in fiscal year 2017. This funding will help modernize and upgrade antiquated infrastructure and address safety and program risks through strategic investments in general purpose infrastructure and capabilities that directly support NNSA's nuclear weapons and nonproliferation programs.

In August 2016, NNSA broke ground on the Administrative Support Complex at the Pantex nuclear weapons assembly and dismantlement facility in Amarillo, Texas. The site's M&O contractor entered into a lease agreement for a new office

building that a private developer is building using third-party financing. This project will allow roughly 1,000 employees to move out of dilapidated, 1950s-era buildings into a modern, energy efficient workspace. It will also eliminate approximately $20 million in deferred maintenance at the Pantex site and enhance recruitment and retention by improving the quality of the work environment. The project will be completed and staff will move into the new facility, by spring 2018.

The fiscal year 2018 budget request further reduces deferred maintenance and supports the execution of new recapitalization projects to improve the condition and extend the design life of structures, capabilities, and systems to meet program demands; decrease overall operating costs; and reduce safety, security, environmental, and program risk. The request also supports general purpose infrastructure and program-specific capabilities through Line Item Construction projects. These projects include the Uranium Processing Facility (UPF) at Y–12, the Chemistry and Metallurgy Research Replacement (CMRR) project at LANL, and the Albuquerque Complex Project.

One of the most worrisome of the NNSA infrastructure challenges is the excess facilities that pose risks to NNSA's workers, the environment, and the nuclear security mission. As of the end of fiscal year 2016, NNSA had 417 excess facilities, 79 of which were identified as high-risk excess facilities, including 58 at the Kansas City Bannister Federal Complex. Many of these facilities will ultimately be transferred to the DOE Office of Environmental Management (EM) for disposition, and the EM fiscal year 2018 budget requests $225 million to address high-risk excess facilities at Y–12 and LLNL. In the interim, NNSA is focusing on reducing the risk where it can. The fiscal year 2018 budget request supports a number of activities related to excess facilities. NNSA benefitted enormously from funding provided by Congress in fiscal year 2017 for the disposition of the Bannister Federal Complex in Kansas City. The disposition project is on track, with final pre-transfer activities occurring now.

The *Office of Defense Nuclear Security (DNS)* develops and implements security programs to protect sensitive nuclear material (SNM), people, information, and facilities throughout the nuclear security enterprise. The fiscal year 2018 budget request is $687.0 million, an increase of $1.5 million, or 0.2 percent over the fiscal year 2017 Omnibus level that included funding to address immediate infrastructure needs at Pantex and Y–12. The request manages risk among important competing demands as NNSA continues to face the challenges associated with physical security infrastructure that must be effectively addressed in the coming years. NNSA is finalizing a 10–Year Plan to Recapitalize Physical Security Systems Infrastructure, also known as the 10–Year Plan, which identifies and prioritizes the replacement and refresh of physical security infrastructure across the nuclear security enterprise. Of note, the request includes preliminary planning and conceptual design funds for future projects, as outlined in the 10–Year Plan, to sustain and recapitalize the Perimeter Intrusion Detection and Assessment System (PIDAS) at the Pantex Plant and Y–12.

Information Technology and Cybersecurity enable every facet of the NNSA mission. The fiscal year 2018 budget request is $186.7 million, an increase of $10 million, or 5.7 percent over the fiscal year 2017 Omnibus level. This increase will fund much needed improvement to the Information Technology and Cybersecurity program, including Continuous Diagnostic and Mitigation, Telecommunications Security, infrastructure upgrades for the Enterprise Secure Computing Network (ESN), Public Key Infrastructure (PKI), Energy Sciences Network program, and an increased information technology budget. The cybersecurity program continuously monitors enterprise wireless and security technologies to meet a wide range of security challenges. In fiscal year 2018, NNSA plans to continue the recapitalization of the ESN, modernize the cybersecurity infrastructure, implement the Identity Control and Access Management project at NNSA Headquarters and site elements, and implement all Committee on National Security Systems and PKI capabilities. The requested funding increase will allow NNSA to continue working toward a comprehensive information technology and cybersecurity program to deliver critical information assets securely.

DEFENSE NUCLEAR NONPROLIFERATION APPROPRIATION

The fiscal year 2018 budget request for the Defense Nuclear Nonproliferation (DNN) account is $1.8 billion, a level consistent with the fiscal year 2017 Omnibus level. This appropriation covers NNSA's critical and far-reaching nuclear threat reduction activities. DNN addresses the entire nuclear threat spectrum by helping to prevent the acquisition of nuclear weapons or weapon-usable materials, technologies, and expertise; countering efforts to acquire them; and responding to pos-

sible nuclear and radiological incidents. The fiscal year 2018 budget request funds two program mission areas under the DNN account: the Defense Nuclear Nonproliferation Program and the Nuclear Counterterrorism and Incident Response (NCTIR) Program.

Nonproliferation Efforts

Working with international partners, the Office of Defense Nuclear Nonproliferation removes or eliminates vulnerable nuclear material; improves global nuclear security through multilateral and bilateral technical exchanges and training workshops; helps prevent the illicit trafficking of nuclear and radiological materials; secures domestic and international civilian buildings containing high-priority radiological material; provides technical reviews of U.S. export license applications; conducts export control training sessions for U.S. enforcement agencies and international partners; strengthens the IAEA's ability to detect and deter nuclear proliferation; advances U.S. capabilities to monitor arms control treaties and detect foreign nuclear programs; and maintains organizational readiness to respond to and mitigate radiological or nuclear incidents worldwide.

The *Material Management and Minimization (M3)* program provides an integrated approach to addressing the risk posed by nuclear materials. The fiscal year 2018 budget request is $332.1 million, an increase of $44 million or, 15.2 percent over the fiscal year 2017 Omnibus level. The request supports the conversion or shut-down of research reactors and isotope production facilities that use HEU; acceleration of new, non-HEU-based molybdenum-99 production facilities in the United States; the removal and disposal of WUNM; and the completion of the lifecycle cost estimate and schedule for the dilute and dispose option for plutonium disposition.

The *Global Material Security (GMS)* program works with partner Nations to increase the security of vulnerable nuclear and radiological materials and improve their ability to detect, interdict, and investigate illicit trafficking of these materials. The fiscal year 2018 budget request for this program is $337.1 million, a decrease of $30 million, or 8.2 percent below the fiscal year 2017 Omnibus level.

The *Nonproliferation and Arms Control (NPAC)* program develops and implements programs to strengthen international nuclear safeguards; control the spread of nuclear and dual-use material, equipment, technology and expertise; verify nuclear reductions and compliance with nonproliferation and arms control treaties and agreements; and address other challenges. The fiscal year 2018 budget request for this program is $129.7 million, an increase of $5 million, or 4.0 percent over the fiscal year 2017 Omnibus level. This increase serves to improve the deployment readiness of U.S. nuclear disablement and dismantlement verification teams and to enhance export control dual-use license and interdiction technical reviews.

The *DNN Research and Development (DNN R&D)* program supports innovative unilateral and multilateral technical capabilities to detect, identify, and characterize foreign nuclear weapons programs, illicit diversion of SNM, and nuclear detonations worldwide. The fiscal year 2018 budget request for this program is $446.1 million, a decrease of $23.7 million, or 5.0 percent below the fiscal year 2017 Omnibus level. The decrease in funding reflects a shift of $53 million from R&D back to M3 for the U.S. High Performance Research Reactors Program and is offset by an increase of $29 million for planned R&D activities.

Nonproliferation Construction consolidates construction costs for DNN projects. The fiscal year 2018 budget request is $279 million, a decrease of $56 million, or 16.7 percent below the fiscal year 2017 Omnibus level. The Administration proposes to terminate the Mixed Oxide Fuel Fabrication (MFFF) project and to pursue the dilute and dispose option to fulfill the United States' commitment to dispose of 34 metric tons of plutonium. If supported by Congress, $270 million would be used to achieve an orderly and safe closure of the MFFF. The scope and costs will be refined in subsequent budget submissions when the termination plan for the MFFF project is approved. In addition, $9 million is provided for the Surplus Plutonium Disposition project to support the dilute and dispose strategy.

Nuclear Counterterrorism and Counterproliferation

In fiscal year 2016, the NCTIR Program transitioned to the DNN account from the Weapons Activities account to align all NNSA funding to prevent, counter, and respond to nuclear proliferation and nuclear terrorism under the same appropriations account. The fiscal year 2018 budget request includes $277.4 million to support the NCTIR Program, an increase of $5 million, or 2.0 percent over the fiscal year 2017 Omnibus level. Within NCTIR, NNSA continues to work domestically and internationally to prepare for and improve the Nation's ability to respond to radiological or nuclear incidents.

NNSA's counterterrorism and counterproliferation programs are part of broader U.S. Government efforts to assess the threat of nuclear terrorism and develop technical countermeasures. The scientific knowledge generated under this program ensures NNSA's technical expertise on potential nuclear threat devices, including improvised nuclear devices (INDs), supports and informs U.S. nuclear security policy, and guides nuclear counterterrorism and counterproliferation efforts, including interagency nuclear forensics and contingency planning.

NNSA emergency response teams' current equipment is aging, resulting in increasing maintenance expenses and imposing increased risks to NNSA's ability to perform its emergency response mission. The Radiological Assistance Program (RAP) remains the Nation's premier first-response resource to assess a radiological incident and advise decision-makers on the necessary steps to minimize hazards. To ensure that NNSA is able to execute its radiological emergency response mission, RAP's equipment must be recapitalized regularly. NNSA is acquiring state-of-the-art, secure, deployable communications systems that are interoperable with Federal Bureau of Investigation and DOD mission partners, ensuring that decision makers receive real-time technical recommendations to mitigate nuclear terrorist threats.

NNSA recently concluded an Analysis of Alternatives (AOA) on the Aerial Measuring System (AMS) aircraft. The AMS fleet consists of three B200 fixed-wing aircraft with an average age of 33 years and two Bell 412 helicopters with an average age of 24 years. The current aircraft are experiencing reduced mission availability due to increasing unscheduled downtime and maintenance. The AOA determined that NNSA recapitalization of the aging aircraft fleet is necessary in order to provide rapid aerial radiological exposure and contamination information to Federal, State, and local officials following an accident or incident in order to protect the public and first responder's health and safety. NNSA anticipates proposing a two-year replacement schedule starting in fiscal year 2019.

NAVAL REACTORS APPROPRIATION

Advancing Naval Nuclear Propulsion

NNSA provides nuclear propulsion for the U.S. Navy's nuclear-powered fleet, which is critical to the security of the United States and its allies as well as the security of global sea lanes. The Naval Reactors Program remains at the forefront of technological developments in naval nuclear propulsion. This preeminence derives from advancing new technologies and improvements in naval reactor performance, ensuring a commanding edge in war.ghting capabilities.

The *Naval Reactors* fiscal year 2018 budget request is $1.48 billion, an increase of $60 million, or 4.2 percent above the fiscal year 2017 Omnibus level. In addition to supporting today's operational fleet, the requested funding will enable Naval Reactors to deliver tomorrow's fleet by funding three national priority projects and recruiting and retaining a highly skilled workforce. The projects include: (1) continuing design and development of the reactor plant for the *Columbia*-class submarine, which will feature a life-of-ship core and electric drive; (2) refueling a Research and Training Reactor in New York to facilitate *Columbia*-class reactor development efforts and provide 20 more years of live reactor-based training for fleet operators; and (3) building a new spent fuel handling facility in Idaho that will facilitate long term, reliable processing and packaging of spent nuclear fuel from aircraft carriers and submarines.

Naval Reactors has requested funding in fiscal year 2018 to support these projects and fund necessary reactor technology development, equipment, construction, maintenance, and modernization of critical infrastructure and facilities. By employing a small but high-performing technical base, the teams at Bettis Atomic Power Laboratory in Pittsburgh, Knolls Atomic Power Laboratory and Kesselring Site in greater Albany, and the spent nuclear fuel facilities in Idaho can perform the research and development, analysis, engineering and testing needed to support today's fleet at sea and develop future nuclear-powered warships. Importantly, the laboratories perform the technical evaluations that enable Naval Reactors to thoroughly assess emergent issues and deliver timely responses that ensure nuclear safety and maximize operational flexibility.

NNSA FEDERAL SALARIES AND EXPENSES APPROPRIATION

The *NNSA Federal Salaries and Expenses (FSE)* fiscal year 2018 budget request is $418.6 million, an increase of $31.5 million, or 8.1 percent over the fiscal year 2017 Omnibus level. The fiscal year 2018 budget request provides funding for 1,715 full-time equivalents (FTE), which includes a 1.9 percent cost of living increase, a 5.5 percent increase for benefit escalation, and other support expenses needed to meet mission requirements. NNSA is actively engaged in hiring to reach that num-

ber in a thoughtful and strategic manner. The fiscal year 2018 budget request for 1,715 FTEs is an increase of 25 above the authorized 1,690. Since 2010, NNSA's program funding has increased 28 percent, while staffing has decreased 17 percent. In fiscal year 2018, NNSA will continue efforts to meet current and future workforce needs by analyzing job requirements to meet evolving missions, including completion of a study by the Office of Personnel Management in support of the Reform of Government Initiative. Initial results from four program offices and one field office indicate the need for a 20 percent increase in federal staff.

MANAGEMENT & PERFORMANCE

Since 2011, NNSA has delivered approximately $1.4 billion in projects, a significant portion of NNSAs total project portfolio, 8 percent under original budget. This past February, the High Explosive Pressing Facility at Pantex achieved CD–4 and was completed $25 million under the approved baseline. NNSA is committed to encouraging competition and increasing the universe of qualified contractors by streamlining its major acquisition processes. NNSA will continue to focus on delivering timely, best-value acquisition solutions for all of its programs and projects, using a tailored approach to contract structures and incentives that is appropriate for the special missions and risks at each site. NNSA's Office of Acquisition and Project Management (APM) is leading continued improvement in contract and project management practices and NNSA's effort to institute rigorous analyses of alternatives; provide clear lines of authority and accountability for program and project managers; improve cost and schedule performance; and ensure Federal Project Directors and Contracting Officers with the appropriate skill mix and professional certifications are managing NNSA's work.

CONCLUSION

NNSA's diverse missions are crucial to the security of the United States, the defense of its allies and partners, and global stability writ large. The U.S. nuclear deterrent has been the cornerstone of America's national security since the beginning of the nuclear age, and NNSA has unique responsibilities to ensure its continued safety, security, reliability, and effectiveness. Likewise, NNSA's nuclear nonproliferation and nuclear counterterrorism activities are essential to promoting the peaceful use of nuclear energy and preventing malicious use of nuclear and radiological materials around the world. Finally, NNSA's support to the U.S. Navy allows the United States to defend its interests abroad and protect the world's commercial shipping lanes. Each of these critical missions depends upon NNSA's capabilities, facilities, infrastructure, and world-class workforce.

Senator FISCHER. Thank you, General.

Ms. Cange, please. Welcome.

STATEMENT OF SUSAN M. CANGE, ACTING ASSISTANT SECRETARY OF ENERGY FOR ENVIRONMENTAL MANAGEMENT, DEPARTMENT OF ENERGY

Ms. CANGE. Thank you, and good afternoon, Chairwoman Fischer, Ranking Member Donnelly, and members of the subcommittee. I'm pleased to be here today to represent the Department of Energy's Office of Environmental Management and to discuss the important work we have recently accomplished, as well as what we plan to achieve under the President's fiscal year 2018 budget request.

The total budget request for the EM [Environmental Management] program is $6.5 billion, and, of that, $5.5 billion is for defense environmental cleanup activities.

Before discussing our request, I'd like to provide a brief update on the recent incident at the Hanford site. As you know, on May 9th, there was a partial collapse of one tunnel near the Purex facility. The tunnel has been used since the 1950s to store contaminated equipment. Based on extensive monitoring, there has been no release of radiological contamination and no workers were injured.

Workers have filled in the collapsed section with soil and placed a cover over the tunnel. We're continuing to ensure that our workers and the public are protected, and we are working closely with the State of Washington for a more permanent solution.

We take this event very seriously and are looking closely at lessons learned. Maintaining and improving aging infrastructure is a priority for the EM program, and this incident emphasizes the need to continue to focus on these efforts.

With regard to recent accomplishments, we continue to demonstrate our ability to make significant progress through achievements like resuming shipments of transuranic waste to the Waste Isolation Pilot Plant, or WIPP; completing the exhumation and packaging of 65,000 cubic meters of buried waste at Idaho; and completing removal of all of the waste from the 618–10 burial grounds at the Hanford site.

Our fiscal year 2018 budget request will enable us to build on this momentum. The request allows EM to continue to make progress in addressing radioactive tank waste, as well as continue other important work such as deactivation and decommissioning; soil and groundwater remediation; and management and disposition of special nuclear materials, spent nuclear fuel, and transuranic and solid waste.

Our request also includes funding to support the National Nuclear Security Administration by tackling some of their higher priority excess facilities in Oak Ridge and at the Lawrence Livermore National Laboratory.

In particular, the fiscal year 2018 request supports continued waste emplacement activities at WIPP. At the Savannah River site, the request supports the commissioning and start-up of the Salt Waste Processing Facility. At Hanford, the budget request supports continued site remediation along the river corridor; and it supports beginning to treat low-activity tank waste by 2023.

In closing, I'm honored to be here today representing the Office of Environmental Management. We're committed to achieving our missions safely and successfully. I'd like to thank you for this opportunity and would be pleased to answer any questions, as time permits.

[The prepared statement of Ms. Cange follows:]

PREPARED STATEMENT BY SUSAN M. CANGE

Good afternoon Chairwoman Fischer, Ranking Member Donnelly, and Members of the Subcommittee. I am pleased to be here today to represent the Department of Energy's (DOE) Office of Environmental Management (EM). At DOE, the safety of our workforce, the communities and tribal Nations that surround our sites, and the environment is the Secretary's highest priority. I would like to provide you with an overview of the EM program, key accomplishments during the past year and planned accomplishments under the President's $6,508,335,000 fiscal year (FY) 2018 budget request.

OVERVIEW OF THE EM MISSION

EM supports the Department of Energy's priorities to meet the challenges leading the cleanup of legacy waste resulting from the Nation's Manhattan Project and Cold War efforts. The EM program was established in 1989 and is responsible for the cleanup of millions of gallons of liquid radioactive waste, thousands of tons of spent nuclear fuel and special nuclear material, disposition of about two million cubic meters of transuranic and mixed/low-level waste, vast quantities of contaminated soil and water, and deactivation and decommissioning of thousands of excess facilities.

This environmental cleanup responsibility results from five decades of nuclear weapons development and production and Government-sponsored nuclear energy research and development. It involves some of the most dangerous materials known to man.

Since 1989, the EM footprint has been reduced significantly, as cleanup activities have been completed at 91 sites in 30 states. For example, the Fernald site in Ohio and the Rocky Flats site in Colorado, both of which once housed large industrial complexes, are now wildlife refuges that are also available for recreational use. At the Hanford Site in Washington State, the bulk of the cleanup along the Columbia River corridor has been completed including: six reactors cocooned, 502 facilities demolished, 1,201 waste sites remediated, and 16 million tons of waste removed. At the Oak Ridge site in Tennessee, we have completed the decommissioning of five gaseous diffusion uranium enrichment processing facilities—the first time such an accomplishment has been achieved in the world. At the Idaho National Laboratory, we have decommissioned and demolished more than two million square feet of excess facilities, and removed all EM special nuclear material (e.g., highly enriched uranium) from the state. At the Savannah River Site, we have vitrified about half of the tank waste, by producing more than 4,100 canisters of glass, we have also permanently closed 8 of 51 high level waste tanks, and successfully decontaminated and decommissioned approximately 290 facilities, including in-situ decommissioning of two former production reactors.

Today, EM is responsible for the remaining cleanup at 16 sites in 11 states. There is less than 300 square miles remaining to be cleaned up across the EM complex and progress continues. However, as many of us know, the remaining cleanup work presents some of our greatest challenges.

EM CLEANUP OBJECTIVES AND PRIORITIES

EM's first priority is worker safety and we continue to pursue cleanup objectives with that in mind. EM will continue to discharge its responsibilities by conducting cleanup within a "Safe Performance of Work" culture that integrates environmental, safety, and health requirements and controls into all work activities. Taking many variables into account, such as risk reduction and compliance agreements, EM has the following priorities:

- Radioactive tank waste stabilization, treatment, and disposal
- Spent nuclear fuel storage, receipt, and disposition
- Special nuclear material consolidation, stabilization, and disposition
- Transuranic and mixed/low-level waste disposition
- Soil and groundwater remediation
- Excess facilities deactivation and decommissioning

In particular, the fiscal year 2018 budget request will allow EM to:

- Continue important cleanup activities at all of our sites in a safe and deliberate manner that ensures protection of our workers, the public and the environment
- Continue waste emplacement at the Waste Isolation Pilot Plant, including increasing the number of shipments
- Continue construction of the Low Activity Waste Facility, Analytical Laboratory, Effluent Management Facility, and supporting facilities at the Hanford site
- Complete commissioning and startup of the Salt Waste Processing Facility at the Savannah River Site
- Continue with commissioning and start-up activities for the Integrated Waste Treatment Unit at Idaho
- Complete design and begin construction of the Mercury Treatment Facility at Oak Ridge

Before discussing recent and near-term accomplishments, I want to provide a brief update on the recent incident at the Hanford Site that pertains to a partial collapse of one tunnel near the Plutonium Uranium Extraction Plant, also known as the PUREX facility. The tunnel, which has not been in operation for decades, has been used since the 1950s to store contaminated equipment from the PUREX operations. On May 9, as a part of our surveillance program, workers discovered that a 20 by 20-foot section of the tunnels had collapsed. Based on extensive radiological monitoring, including monitoring performed by the State of Washington's Department of Health, there has been no release of radiological contamination from the incident, and no workers were injured or exposed to radiological material as a result.

Workers have since filled in the collapsed section with soil and have placed a cover over the length of the tunnel. We are working closely with the state of Wash-

ington on longer-term actions which are under development. We take this event seriously, we will look closely at lessons learned from this event that may apply to other EM facilities. We are continuing to minimize the potential of a radiological release and ensure that our workers and the public are protected. We are committed to working with the State of Washington for a more permanent solution that focuses on maintaining the structural integrity of the tunnel and that permanently addresses the waste.

KEY RECENT AND NEAR-TERM ACCOMPLISHMENTS

I would now like to take this opportunity to highlight a number of EM's most recent accomplishments. Recently, the Waste Isolation Pilot Plant (WIPP) received its first shipments of transuranic (TRU) waste since it re-opened in January 2017. The shipments from the Idaho National Laboratory, Savannah River Site, and Waste Control Specialists in Texas were an important milestone for WIPP and for sites that stored TRU waste since WIPP ceased operations in February 2014. Shipments from Oak Ridge and Los Alamos National Laboratory are expected later this year. WIPP is currently receiving three shipments a week, and is expected to ramp up to four shipments a week by the end of 2017. This year, WIPP anticipates receipt of approximately 130 shipments of waste for emplacement in the underground.

EM is continuing to make steady and substantial cleanup progress across the complex. At the Savannah River Site, construction of the Salt Waste Processing Facility is complete. Once in operation, it will significantly accelerate EM's ability to treat tank waste at SRS. At Hanford, demolition of the Plutonium Finishing Plant, once one of the most dangerous buildings in the DOE complex, is now underway and is scheduled for completion later this year. This winter, workers at Idaho's Advanced Mixed Waste Treatment Facility completed a15-year effort to retrieve, characterize, treat and package more than 65,000 cubic meters of TRU waste (plutonium-contaminated waste boxes, drums, and dirt) to ready it for shipment to WIPP.

HIGHLIGHTS OF THE FISCAL YEAR 2018 BUDGET REQUEST

The fiscal year 2018 budget request for EM is the largest request in ten years and includes $5,537,186,000 for defense environmental cleanup activities, of which $225,000,000 would be used to address excess facilities to support modernization of the nuclear security enterprise. The Department's Excess Contaminated Facilities Working Group analyzed and developed options for how DOE may prioritize and address the numerous contaminated excess facilities owned by the various DOE program offices. The fiscal year 2018 budget request implements a targeted effort to accelerate deactivation and decommissioning (D&D) of specific high-risk facilities at the Y–12 National Security Complex and the Lawrence Livermore National Laboratory not currently in the Environmental Management programs' inventory to achieve substantial risk reduction within four years.

The request will allow EM to maintain a safe and secure posture across the complex, while continuing compliance activities. In fiscal year 2018, we expect to continue to make significant progress in addressing radioactive tank waste at EM sites, as well as to continue our D&D activities and our soil and groundwater remediation activities. In addition, we will continue to manage and disposition special nuclear materials, spent nuclear fuel and transuranic and solid waste.

At WIPP, the fiscal year 2018 request supports continued waste emplacement and ramps up receipt of TRU waste shipments. It also supports the completion of design work and begins construction of the new ventilation system and exhaust shaft.

At the Savannah River Site, the fiscal year 2018 request supports the commissioning and startup of the Salt Waste Processing Facility, and the operation of the Defense Waste Processing Facility to produce 60 to 70 canisters of vitrified high-level waste. In addition, the request initiates the design of the Emergency Operations Center replacement project and supports the safe and secure operation of the H Canyon/ HB–Line for the purpose of processing aluminum-clad spent nuclear fuel and down-blending EM-owned plutonium. These processing activities will, ensure the availability of space in K– and L–Areas for the future receipt of excess research nuclear material that has been removed from civilian sites in foreign countries. These removals provide for safe, secure storage of this material.

At Hanford, EM is working aggressively to complete and commission treatment facilities to safely immobilize tank waste for disposition. The Office of River Protection's fiscal year 2018 budget request represents planned efforts for continued progress required by the Tri-Party Agreement and 2016 Amended Consent Order. The request is designed to maintain safe operations for the tank farms; achieve progress in meeting regulatory commitments; support the development and maintenance of infrastructure necessary to enable waste treatment operations; continue

construction at the Waste Treatment and Immobilization Plant's (WTP) Low-Activity Waste Facility, Effluent Management Facility, Balance of Facilities, and Analytical Laboratory to support treatment of tank waste by 2023; and resolve significant technical issues with the WTP Pretreatment facility.

Ongoing Hanford cleanup efforts will continue at the Richland Operations Office. The fiscal year 2018 budget request supports waste site remediation activities along the River Corridor and operations necessary to provide monitoring of the 324 Building; continues groundwater remediation and continues progress on the K West Basin sludge removal project.

At the Idaho National Laboratory, the fiscal year 2018 request supports buried waste retrieval activities and work necessary to commission and startup the Integrated Waste Treatment Unit. Once this facility is in operation, it will treat the approximately 900,000 gallons of radioactive sodium bearing waste. The request also supports repackaging and the characterization of contact-handled transuranic waste at the Advanced Mixed Waste Treatment Project.

At Oak Ridge, the request supports continued demolition of the remaining facilities and site restoration at the East Tennessee Technology Park, as well as completion of the design and initiation of early site preparations for the Mercury Treatment Facility at the Y–12 National Security Complex. Additionally, the budget supports preparation of Building 2026 at the Oak Ridge National Laboratory to support processing of uranium-233 materials.

With some of the most challenging cleanup work still remaining in the EM program, we understand the importance of technology development in reducing lifecycle costs and enhancing our effectiveness. To help address many of the technical challenges involved with high-risk cleanup activities, the fiscal year 2018 request of $25,000,000 for Innovation and Technology Development projects to tackle our greatest challenges with remediation of Technetium-99, Mercury, Cesium-137 and Strontium-80, and the integration of advanced tooling and robotics for enhanced worker safety and productivity.

BUDGET AUTHORITY AND PLANNED ACCOMPLISHMENTS BY SITE

Office of River Protection, Washington
(dollars in thousands)

Fiscal Year 2017 Enacted	Fiscal Year 2018 Request
$1,499,965	$1,504,311

Key Accomplishments Planned for Fiscal Year 2018

- Continues construction and commissioning activities for the Direct Feed Low Activity Waste approach at the Waste Treatment and Immobilization Plant, and Low Activity Waste Pretreatment System
- Maintains tank farms in a safe and compliant manner
- Conducts Single-Shell/Double-Shell Tank Integrity assessments
- Supports single-shell tank retrieval activities and continues work to address tank vapor safety concerns.

Savannah River Site, South Carolina
(dollars in thousands)

Fiscal Year 2017 Enacted	Fiscal Year 2018 Request
$1,369,429	$1,447,591

Key Accomplishments Planned for Fiscal Year 2018

- Completes Salt Waste Processing Facility commissioning and startup in late 2018
- Brings the Defense Waste Processing Facility back online to continue vitrifying high-level waste
- Initiates Saltstone Disposal Unit #7 design and initiate long-lead procurement for cell construction
- Down-blends EM-owned (non-MOXable) surplus non-pit plutonium for disposal at Waste Isolation Pilot Plant
- Processes aluminum clad spent nuclear fuel

Carlsbad Field Office, New Mexico
(dollars in thousands)

Fiscal Year 2017 Enacted	Fiscal Year 2018 Request
$324,720	$323,041

Key Accomplishments Planned for Fiscal Year 2018

- Continues waste emplacement and ramps up receipt of TRU waste shipments
- Completes design and begins construction on the new ventilation system and exhaust shaft

Los Alamos National Laboratory, New Mexico
(dollars in thousands)

Fiscal Year 2017 Enacted	Fiscal Year 2018 Request
$194,000	$191,629

Key Accomplishments Planned for Fiscal Year 2018

- Continues chromium plume investigation
- Completes town site cleanup of solid waste management units from the 1940s and 1950s production sites

Idaho National Laboratory, Idaho
(dollars in thousands)

Fiscal Year 2017 Enacted	Fiscal Year 2018 Request
$382,088	$350,226[1]

[1] The amount reflects Defense Environmental Cleanup portion, the total Idaho National Laboratory Fiscal Year 2018 Request is $359,226,000.

Key Accomplishments Planned for Fiscal Year 2018

- Continues with the deliberate commissioning and start-up of the Integrated Waste Treatment Unit to treat liquid radioactive sodium bearing waste
- Continues buried waste retrieval activities
- Supports repackaging and the characterization of contact-handled transuranic waste at the Advanced Mixed Waste Treatment Project
- Treats and disposes mixed low-level and low-level waste offsite
- Maintains all dry spent nuclear fuel storage facilities

Oak Ridge Site, Tennessee
(dollars in thousands)

Fiscal Year 2017 Enacted	Fiscal Year 2018 Request
$278,719	$225,205[2]

[2] The amount reflects Defense Environmental Cleanup portion, the total Oak Ridge Fiscal Year 2018 Request is $390,205,000.

Key Accomplishments Planned for Fiscal Year 2018

- Completes design and begins construction of the Mercury Treatment Facility
- Continues capital asset project to support processing U–233 materials
- Supports transuranic waste characterization and shipments to WIPP

Richland Operations Office, Washington
(dollars in thousands)

Fiscal Year 2017 Enacted	Fiscal Year 2018 Request
$913,936	$798,192[3]

[3] The amount reflects Defense Environmental Cleanup portion, the total Richland Fiscal Year 2018 Request is $800,422,000.

Key Accomplishments Planned for Fiscal Year 2018

- Continues K Basin sludge removal and supports operations and maintenance of K West Basin
- Supports safe storage of nearly 2,000 cesium and strontium capsules in the Waste Encapsulation and Storage Facility, and continues project planning for dry storage options for the capsules
- Continues integration of site-wide groundwater and vadose zone cleanup activities, groundwater monitoring, operations, maintenance, and necessary modifications of existing remediation systems
- Continues soil and waste site remediation along River Corridor

Nevada National Security Site, Nevada
(dollars in thousands)

Fiscal Year 2017 Enacted	Fiscal Year 2018 Request
$62,176	$60,136

Key Accomplishments Planned for Fiscal Year 2018

- Completes characterization activities for six contaminated soil sites
- Completes closure activities for one soil corrective action site
- Supports cleanup activities across the DOE complex by providing disposal capacity and services for up to 1.2 million cubic feet of low-level and mixed low-level radioactive waste

CONCLUSION

Madam Chairwoman Fischer, Ranking Member Donnelly, and Members of the Subcommittee, I am honored to be here today representing the over 20,000 men and women that carry out the Office of Environmental Management mission. Our request will enable us to continue to make progress with our mission and to realize a significant set of accomplishments across the EM program. We are committed to achieving our mission and will continue to apply innovative environmental cleanup strategies to complete work safely and efficiently, thereby demonstrating value to the American taxpayers. All of this work will, first and foremost, be done safely, within a framework of best business practices. I am pleased to answer any questions you may have.

Senator FISCHER. Thank you very much.

Admiral Caldwell, welcome, sir.

STATEMENT OF ADMIRAL JAMES F. CALDWELL, JR., USN, DEPUTY ADMINISTRATOR FOR NAVAL REACTORS, NATIONAL NUCLEAR SECURITY ADMINISTRATION

Admiral CALDWELL. Thank you, Chairwoman Fischer and Ranking Member Donnelly, and distinguished members of this subcommittee. Thank you for the opportunity to testify before you today. This is my second appearance before this subcommittee, and I am grateful for the tremendous support that the subcommittee has shown Naval Reactors. Your support is essential to our program.

Since I last testified before this subcommittee, U.S. nuclear-powered warships, which include 10 aircraft carriers, 14 ballistic missile submarines, 57 attack submarines, and 4 guided missile sub-

marines, have steamed over 2 million miles in support of national security missions. We have 101 reactors across our program that operated safely and effectively for another year. This is a true testament to the sailors who operate these propulsion systems and the technical base that supports them.

Nuclear power is a key enabler to the success of our Nation's Navy, both in the missions it supports and the capability advantage that it affords over adversaries. Nuclear-powered submarines and aircraft carriers make up over 45 percent of the Navy's major combatants, and as we move forward it is vital to our national security to continue to build and improve upon these incredible assets.

Last year marked the start of an ongoing program that delivers two *Virginia*-class submarines annually. Recently, the Navy commissioned the attack submarine Illinois, completed initial C trials on PCU Washington, and christened the *Colorado* and the *Indiana.* Just this last month we completed C trials on the *Ford,* the Nation's newest aircraft carrier.

Having witnessed *Ford's* propulsion plant testing firsthand, I am happy to report that in terms of propulsion capability, *Ford* met the high speed of our *Nimitz*-class carriers while delivering major increases in electrical power generation and core energy with half of the manning in the reactor department.

Nuclear power continues to play an important role in our military strategic deterrent mission. Our ballistic missile submarine force achieved over 60 years of peacekeeping through continuous at-sea strategic deterrence. This milestone occurs as the Nation is preparing to recapitalize the ballistic missile submarine force through the procurement of the *Columbia*-class ballistic missile submarine. That will enable undersea deterrence through the year 2080.

Over the past year our technical base of scientists, engineers, and logisticians were vital to the continued operation of the Navy's nuclear fleet. This core team directly supports the Navy's ability to maintain a forward-deployed carrier, 3 battle group deployments last year, 33 submarine deployments, and 32 strategic ballistic missile deterrent patrols.

Our progress in mandatory oversight of the safe operation of the fleet is only possible through the support of this subcommittee. Naval Reactors funding request for fiscal year 2018 allows us to continue this important work. The funding request is for $1.48 billion. That's approximately a 4 percent increase over the fiscal year 2017 enacted funding level. This request enables us to deliver tomorrow's fleet while recapitalizing critical program facilities and infrastructure, while performing research and development, and funding 3 national priority projects, which are the continued design of the new propulsion plant for the *Columbia* SSBN, which will feature a life-of-core reactor and electric drive; refueling a research and training reactor in New York to facilitate the *Columbia*-class reactor manufacturing development efforts, which will also provide 20 more years of training fleet operators; and building a new spent fuel handling facility in Idaho that will facilitate long-term, reliable processing and packaging of naval spent nuclear fuel.

The budget request supported by sustained and predictable funding levels also permits Naval Reactors to support today's operational fleet by recruiting and retaining talented engineers, technicians, and scientists that make up the technical base. This technical base includes world-class laboratory and reactor facilities and allows me to support maintenance and modernization investments that are critical to the fleet.

Madam Chairwoman, our fiscal year 2018 budget request is part of a closely coordinated Department of Navy and Department of Energy budget that supports both my responsibility to regulate the safe and effective operation of the nuclear fleet, and Naval Reactors roles in both departments to support the security of our Nation and our future security. We will accomplish this with industry partners while maintaining high standards for safety and environmental stewardship.

Again, thank you for your longstanding support, and I look forward to discussing my program with you.

[The prepared statement of Admiral Caldwell follows:]

PREPARED STATEMENT BY ADMIRAL JAMES F. CALDWELL

Since USS *Nautilus* (SSN 571) first signaled *"Underway on nuclear power"* in 1955, our nuclear powered ships have made extraordinary contributions to our national defense. From the start of the Cold War to today's multi-threat environment, our nuclear navy ensures continued dominance of American seapower. Over 45 percent of the Navy's major combatants are nuclear powered (10 aircraft carriers, 14 ballistic missile submarines, 57 attack submarines, and 4 guided missile submarines) capitalizing on the mobility, flexibility, and endurance of nuclear power that enables the Navy to meet its global mission.

Over the past year, the Navy, with Naval Reactors support, deployed 33 submarines and conducted 32 strategic deterrent patrols. In addition, at any given time, there were always at least 56 of 75 submarines deployed or ready to deploy within a few days. Our carriers, USS *John C. Stennis* (CVN 74), USS *Harry S. Truman* (CVN 75), and USS *Dwight D. Eisenhower* (CVN 79), completed successful deployments, and the USS *Ronald Reagan* (CVN 76) stood ready as the forward-deployed carrier in Japan. We also saw the christening of the attack submarines PCU *Colorado* (SSN 788) and PCU *Indiana* (SSN 789), our fifteenth and sixteenth *Virginia*-class submarines. We have also added another attack submarine to our force by commissioning USS *Illinois* (SSN 786), and we've completed initial sea trials for the Navy's newest submarine USS *Washington* (SSN 787). Last, as a testament to the ability of our design and technical base, USS *Helena* (SSN 725) made submarine history by being the first submarine to travel 1 million nautical miles on a single reactor core.

Recently, I participated in sea-trials on the first *Ford*-class aircraft carrier, the *Gerald R. Ford* (CVN 78). This ship has the first new design aircraft carrier propulsion plant in 40 years, and I'm happy to report that in terms of propulsion capability, *Ford* met the high speed of our *Nimitz*-class ships and delivered major increases in electrical power and core energy with half the manning in the reactor department. While we have worked through several challenges testing and operating the first-of-class propulsion and electrical generation and distribution system on the ship, the fact that these problems were safely and efficiently resolved is a testament to the technical skills and hard work of the nuclear shipbuilding design and industrial base, as well as the skilled sailors operating this equipment. This historic milestone represents the culmination of almost 20 years of dedicated and sustained effort by Naval Reactors and its field activities, our Department of Energy laboratories, nuclear industrial base suppliers, the Navy design team, and the nuclear shipbuilders.

In addition to supporting these nuclear powered combatants, Naval Reactors has safely maintained and operated two nuclear powered land-based prototypes—both over 39 years old—to conduct research, development, and training, as well as two Moored Training Ships—both over 53 years old—the oldest operating pressurized water reactors in the world. These operational reactors provide highly qualified operators to the nuclear fleet, and today our nuclear fleet is fully manned.

The strong support of this subcommittee last year enabled safe operation of the fleet, Naval Reactors mandatory oversight, and continued progress on key projects. Naval Reactors' budget request for fiscal year (FY) 2018 is $1.48 billion, an increase of 60 million dollars, or 4 percent, over the fiscal year 2017 enacted funding level. In addition to supporting today's operational fleet, the requested funding will enable Naval Reactors to deliver tomorrow's fleet by continuing funding for three national priority projects and recruiting and retaining a unique, highly skilled work force committed to the Navy and the nation. The projects are:

- Continuing to design the new propulsion plant for the *Columbia*-class ballistic missile submarine, which will feature a life-of-ship core and electric drive;
- Refueling a research and training reactor in New York, to facilitate *Columbia*-class reactor development efforts and provide 20 more years of live reactor based training for the fleet operators; and
- Building a new Spent Fuel Handling Facility in Idaho that will facilitate long term, reliable processing and packaging of spent nuclear fuel from aircraft carriers and submarines.

We are at our peak in design efforts supporting the new propulsion plant for the *Columbia*-class SSBN—the Navy's number one acquisition priority. Providing unparalleled stealth, endurance, and mobility, our ballistic missile submarine force has delivered more than 60 years of continuous at-sea deterrence, and it continues to be the most survivable leg of the nuclear triad. *Columbia*-class SSBN activity this year includes reactor plant design and component development to support procurement of long lead reactor plant components in fiscal year 2019. The funding requested ensures we maintain progress with this plan and alignment with the Navy as the program moves toward construction start in fiscal year 2021.

Supporting both the *Columbia*-class effort and the Program's training needs, the fiscal year 2018 budget request supports the land-based prototype refueling overhaul at the Kesselring Site in upstate New York. In fiscal year 2018, Naval Reactors continues the core manufacturing work needed for the refueling overhaul, which retires manufacturing risk for the life-of-ship core for *Columbia*-class. Further, plant service-life engineering design will be largely completed in fiscal year 2018 to ensure that the land-based prototype overhaul, performed concurrently with refueling, supports 20 additional years of Naval Reactors' commitment to research, development, and training in upstate New York.

The Naval Reactors fiscal year 2018 Budget Request also contains funds to continue the Spent Fuel Handling Recapitalization Project. Congressional support in fiscal year 2016 and fiscal year 2017 for this much needed project has enabled progress on site preparations, long lead material procurements starting this fiscal year, and approval of the National Environmental Policy Act Environmental Impact Statement Record of Decision. In addition to starting site preparation and long lead material procurements, we are using the $100 million received in fiscal year 2017 to finalize key facility and equipment requirements and advance facility design to support establishing the Performance Baseline and authorizing the start of construction in fiscal year 2018. Continued Congressional support will ensure that the facility in Idaho is ready to receive spent nuclear fuel from aircraft carriers in fiscal year 2024 and be fully operational by 2025.

In addition to our three main priority projects, Naval Reactors also maintains a high-performing technical base to execute nuclear reactor technology research and development that guarantees our Navy remains technologically ahead of adversaries, as well as the necessary equipment, construction, maintenance, and modernization of critical infrastructure and facilities. By employing an efficient and effective technical base, the teams of talented and dedicated people at our four Program sites—the Bettis Atomic Power Laboratory in Pittsburgh, the Knolls Atomic Power Laboratory and Kesselring Site in greater Albany, and the Naval Reactors Facility in Idaho—can perform the research and development, analysis, engineering, and testing needed to support today's fleet at sea and develop more capable nuclear-powered warships. Our labs perform the technical evaluations that enable Naval Reactors to thoroughly assess approximately 4,000 emergent issues annually and deliver timely responses that ensure nuclear safety and maximize operational flexibility. This technical base supports more than 17,500 nuclear-trained Navy sailors, who safely maintain and operate the 101 nuclear propulsion plants in the fleet 24 hours per day, 365 days per year around the globe.

At the requested funding level, Naval Reactors can safely maintain and oversee the nuclear-powered fleet. Naval Reactors is committed to executing our projects on time and on budget, and continuing the drive for the safest and most cost effective way to support the nuclear fleet. I respectfully urge your support for aligning funding allocations with the fiscal year 2018 Budget Request.

Senator FISCHER. Thank you, Admiral.

Director Trimble, welcome.

STATEMENT OF DAVID C. TRIMBLE, DIRECTOR, NATURAL RESOURCES AND ENVIRONMENT, GOVERNMENT ACCOUNTABILITY OFFICE

Mr. TRIMBLE. Thank you, Chairman Fischer, Ranking Member Donnelly, and members of the subcommittee. My testimony today will address the affordability of NNSA's nuclear modernization programs, the growing cost of DOE's environmental liabilities, DOE's efforts to improve its management of contracts and projects, and assessing performance in the non-proliferation program.

NNSA faces challenges with the affordability of its nuclear modernization programs. In our review of the fiscal year 2017 SSMP [Stockpile Stewardship and Management Plan], we found misalignment between NNSA's modernization plans and projected budgetary resources, which could make it difficult for NNSA to afford its planned portfolio of modernization programs.

We identified two areas of misalignment. First, NNSA's estimates of program costs exceeded the projected budgetary resources included in the President's planned near- and long-term modernization budgets. For example, we found that to stay within five-year budget limits, NNSA continues to push work out beyond the FYNSP [Future Year Nuclear Security Plan], something it has repeatedly done in the past. Such "bow waves" of increased future budget needs often occur when agencies are undertaking more program than their resources can support.

Long-term modernization budgets also show a shortfall, with program costs of about $3 billion more than the projected budgets.

Second, the cost of three LAPS [Logistics, Accountability, Planning and Scheduling]—the B61, W80, and W88—could be about $4 billion higher than estimated. Moreover, projected budgets for some programs are not always sufficient to cover even the low end of projected costs.

Addressing the affordability challenges facing the modernization effort is complicated by DOE's growing environmental liabilities, which defense up-budgets will also need to fund. This year we added the Federal Government's environmental liabilities to our high-risk list. Notably, DOE is responsible for $372 of the $450 billion Federal total. Further, over the past six years, EM has spent about $35 billion on cleanup, while its liabilities have grown by $90 billion in the same time period. Also of concern is that these liability estimates do not include all future cleanup responsibilities.

We and others have found that DOE has not consistently taken a risk-informed approach to decision-making for environmental cleanup. Our recent work has identified opportunities where DOE may be able to save tens of billions of dollars such as by taking a risk-informed approach to treating a portion of the low-activity waste at the Hanford site.

Regarding DOE contract and project management, which has been on GAO's [Government Accountability Office] high-risk list for several decades, DOE has taken several important steps, including requiring the development of cost estimates in accordance with best practices, creating new oversight structures, and ensuring that

major projects, designs, and technologies are sufficiently mature before construction.

Significant work remains. First, DOE still lacks reliable enterprise-wide cost information. Without this information, meaningful cost analyses across programs, contractors, and sites are not possible. NNSA needs to develop a comprehensive plan to address this issue.

Second, DOE has not established a policy on program management or a training program for program managers. Program management can help ensure that a group of related projects and activities are managed in a coordinated way to obtain benefits not available for managing them individually.

Third, DOE's acquisition planning for major contracts could be improved. While DOE has since revised its guidance, in our last report we found that it had not considered an acquisition alternative beyond continuing its longstanding M&O [Management and Operating] approach in 16 of the 22 cases we examined. By not considering alternative structures, DOE could not be sure that it had selected the most effective form of contracts for billions in annual spending.

Fourth, DOE has not consistently applied its recent reforms to its largest legacy cleanup project at the Hanford site. In light of longstanding challenges with the WTP [Waste Treatment Plant] and the billions of dollars yet to be spent, DOE should ensure that its improved controls are applied to its largest and most troubled project.

Finally, DOE's efforts to ensure contractors maintain an environment for workers to raise concerns without fear of reprisals has not been sufficient. As we reported, management must foster a culture in which workers are encouraged to identify risks and use their expertise to proactively mitigate them.

Lastly, regarding non-proliferation, DNN [Defense Nuclear Nonproliferation] faces challenges with assessing the performance of some of its programs. We found that DNN's R&D [Research and Development] results were not being tracked consistently to help evaluate the success of that program. In addition, we found that DOE did not have measureable goals supporting its plans and efforts to deploy and support detection equipment overseas.

Also related to non-proliferation, let me note that we have ongoing work for this committee related to MOX [Mixed Oxide Fuel Fabrication Facility] and WIPP.

Thank you, and I'd be happy to answer any questions you may have.

[The prepared statement of Mr. Trimble follows:]

United States Government Accountability Office

GAO

Testimony

Before the Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate

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DEPARTMENT OF ENERGY

Continued Actions Needed to Address Management Challenges

Statement of David C. Trimble,
Director Natural Resources and Environment

GAO-17-651T

May 24, 2017

GAO Highlights

Highlights of GAO-17-651T, a testimony before the Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate

DEPARTMENT OF ENERGY

Continued Actions Needed to Address Management Challenges

Why GAO Did This Study

DOE's NNSA is responsible for managing the nuclear weapons stockpile and supporting nuclear nonproliferation efforts. DOE's Office of Environmental Management's mission includes decontaminating and decommissioning facilities that are contaminated from decades of nuclear weapons production.

Over the last few years, GAO has reported on a wide range of challenges facing DOE and NNSA. These challenges contribute to GAO's continuing inclusion of DOE's and NNSA's management of major contracts and projects on the list of agencies and program areas that are at high risk of fraud, waste, abuse, and mismanagement, or are in need of transformation. GAO also recently added the U.S. government's environmental liabilities to this list.

This statement is based on 13 GAO reports issued from May 2015 through May 2017 and discusses (1) challenges related to the affordability of NNSA's nuclear modernization plans, (2) the status of DOE's efforts to improve its management of contracts and projects, (3) challenges in addressing DOE's environmental liabilities, and (4) challenges facing NNSA's nonproliferation programs.

What GAO Recommends

GAO is not making any new recommendations in this statement. GAO has suggested that Congress consider taking certain actions and that DOE continue to act on the numerous recommendations made to address these challenges. GAO will continue to monitor DOE's implementation of these recommendations.

View GAO-17-651T. For more information, contact David Trimble at (202) 512-3841 or trimbled@gao.gov.

What GAO Found

The Department of Energy's (DOE) National Nuclear Security Administration (NNSA) faces challenges related to the affordability of its nuclear modernization programs. GAO found in April 2017 that these challenges were caused by a misalignment between NNSA's modernization plans and the estimated budgetary resources needed to carry out those plans. First, GAO found that NNSA's estimates of funding needed for its modernization plans sometimes exceeded the budgetary projections included in the President's planned near-term and long-term modernization budgets. Second, GAO found that the costs of some major modernization programs—such as for nuclear weapon refurbishments—may also increase and further strain future modernization budgets that currently do not anticipate these potential increases. GAO recommended in April 2017 that NNSA include an assessment of the affordability of its modernization programs in future versions of its annual plan on stockpile stewardship; NNSA neither agreed nor disagreed with that recommendation.

DOE has taken several important steps that demonstrate its commitment to improving contract and project management, but challenges persist. In recent reports, GAO has noted progress as DOE has developed and implemented corrective actions to identify and address root causes of persistent project management challenges and progress in its monitoring of the effectiveness and sustainability of corrective actions. However, DOE's recent efforts do not address several areas of contract and project management where the department continues to struggle. GAO has made several recommendations related to these issues, many of which DOE has not yet implemented.

DOE also faces challenges with addressing its environmental liabilities—the total cost of its cleanup responsibilities. In February 2017, GAO found that DOE was responsible for over 80 percent ($372 billion) of the U.S. government's estimated $450 billion environmental liability. However, this estimate does not reflect all of DOE's cleanup responsibilities. For example, in January 2017, GAO found that the cost estimate for DOE's proposal for separate defense and commercial nuclear waste repositories excluded the costs and time frames for key activities, and therefore full costs are likely to be billions of dollars more than DOE's reported environmental liabilities. To effectively address cleanup, GAO and other organizations have reported that DOE needs to take a nation-wide, risk-informed approach, which could reduce long-term costs as well as environmental risks more quickly. Since 1994, GAO has made at least 28 recommendations to address the federal government's environmental liability and 4 suggestions to Congress to consider changes to the laws governing cleanup activities. Of these, 13 recommendations remain unimplemented.

Finally, NNSA faces challenges in implementing its nonproliferation programs. For example, in June 2016, GAO found that NNSA's Nuclear Smuggling Detection and Deterrence program had developed a program plan, but NNSA could not measure progress because not all of the program's goals were measurable, and performance measures were not aligned with the goals. As a result, NNSA may not be able to determine when the program has fully achieved its mission. GAO has made several recommendations related to NNSA's nonproliferation programs, some of which NNSA has yet to implement.

Chair Fischer, Ranking Member Donnelly, and Members of the Subcommittee:

Thank you for the opportunity to discuss our recent work on some of the pressing management challenges facing the Department of Energy (DOE) and its National Nuclear Security Administration (NNSA).[1] NNSA is responsible for managing the nation's nuclear security missions: ensuring a safe, secure, and reliable nuclear deterrent; achieving designated reductions in the nuclear weapons stockpile; and supporting the nation's nuclear nonproliferation efforts. To implement NNSA's weapons modernization plans, the agency's February 2016 budget justification for the Weapons Activities appropriations account included about $49.4 billion for fiscal years 2017 through 2021, of which about $9.2 billion was for fiscal year 2017. In addition, DOE, through its Office of Environmental Management (EM), is responsible for decontaminating and decommissioning nuclear facilities and sites that are contaminated from decades of nuclear weapons production and nuclear energy research. Since its inception in 1989, EM has spent over $164 billion on cleanup efforts, including to retrieve, treat, and dispose of nuclear waste.

Since the end of the Cold War, key portions of the nuclear security enterprise's weapons production infrastructure have aged and become outdated, prompting congressional and executive branch decision makers to call on DOE to develop plans to modernize this infrastructure.[2] The Department of Defense's (DOD) 2010 Nuclear Posture Review identified long-term modernization goals and requirements, including sustaining a safe, secure, and effective nuclear arsenal through increasing investments to rebuild and modernize the nation's nuclear infrastructure, some of which dates back to the 1940s.[3] In fiscal year 2011, the

[1]NNSA is a separately organized agency within the Department of Energy. It was created under Title 32 of the National Defense Authorization Act for Fiscal Year 2000, Pub. L. No. 106-65, § 3201 et seq.

[2]The end of the Cold War caused a dramatic shift in how the nation maintains nuclear weapons. Instead of designing, testing, and producing new nuclear weapons, the strategy shifted to maintaining the existing nuclear weapons stockpile indefinitely. Life extension programs increase, through refurbishment, the operational lives of weapons in the nuclear stockpile by 20 to 30 years and certify these weapons' military performance requirements without conducting underground nuclear testing.

[3]Department of Defense, *Nuclear Posture Review Report* (Washington, D.C.: Apr. 6, 2010). The 2010 Nuclear Posture Review establishes the nation's nuclear weapons requirements and policy.

administration pledged over $88 billion to NNSA over 10 years for operations and modernization, including the refurbishment of weapons in the current stockpile and the construction of facilities to support these refurbishments. In January 2017, the President directed the Secretary of Defense to initiate a new Nuclear Posture Review to ensure that the United States nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st-century threats and reassure our allies.

To support its modernization and cleanup missions, DOE relies primarily on contractors to carry out its programs. DOE is the largest civilian contracting agency in the federal government and spends approximately 90 percent of its $32 billion in funding (in fiscal year 2017) on contracts and large capital asset projects. We designated DOE's contract management—which has included both contract administration and project management—as a high-risk area in 1990 because DOE's record of inadequate management and oversight of contractors had left it vulnerable to fraud, waste, abuse, and mismanagement.

Reports we have issued over the past several years have highlighted various challenges that NNSA and EM continue to face in carrying out their mission-related responsibilities, including challenges in contract and project management that relate to NNSA's modernization activities and EM's cleanup efforts. In our 2017 high-risk update, we reported that NNSA and EM continued to demonstrate a strong commitment and top leadership support to improve contract and project management—a key criterion for removing agencies and program areas from our High-Risk List.[4] However, we also found that DOE still needs to make more progress on the other four criteria for removal: organizational capacity, corrective action planning, monitoring effectiveness, and demonstrating progress. Our high-risk update also noted that NNSA and EM continued to struggle to stay within cost and schedule estimates for some of their major projects.

As NNSA works to modernize the nuclear security enterprise, EM must address the legacy of 70 years of nuclear weapons production and

[4]GAO, *High-Risk Series: Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others*, GAO-17-317 (Washington, D.C.: Feb. 15, 2017). GAO's high-risk program identifies government operations with greater vulnerabilities to fraud, waste, abuse, and mismanagement or the need for transformation to address economy, efficiency, or effectiveness challenges.

energy research by DOE and its predecessor agencies. These activities generated large amounts of radioactive waste, spent nuclear fuel, excess plutonium and uranium, and contaminated soil and groundwater. They also resulted in thousands of contaminated facilities, including land, buildings, and other structures and their systems and equipment. Various federal laws, agreements with states, and court decisions require the federal government to clean up environmental hazards at federal sites and facilities—such as nuclear weapons production facilities. DOE's approaches to addressing its environmental liabilities and cleaning up the contamination from past activities are often influenced by numerous site-specific factors, stakeholder agreements, and legal provisions. For years, we and others have reported on shortcomings in DOE's approach to addressing its environmental responsibilities, including incomplete data on the extent of cleanup needed, and in 2017 we added federal environmental liabilities to our High-Risk List—over 80 percent of these liabilities are DOE's responsibility.[5] In our 2017 high-risk update, we reported that because of incomplete information and often inconsistent approaches to making cleanup decisions, DOE does not always approach environmental cleanup using a risk-informed approach to reduce health and safety risks in a cost effective manner.

My testimony today discusses (1) challenges related to the affordability of NNSA's nuclear modernization programs, (2) the status of DOE's efforts to improve its management of contracts and projects, (3) challenges in addressing DOE's environmental liabilities, and (4) challenges facing NNSA's nonproliferation programs. My statement is based primarily on information from 13 GAO reports issued from May 2015 to May 2017 (see the end of the testimony for a list of related reports). For that work, we reviewed agency documents and interviewed agency officials, among other things. Detailed information about the scope and methodology we used to conduct our prior work can be found in each of our issued reports. The work upon which this testimony is based was conducted in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

[5]GAO-17-317.

Misalignment between NNSA's Modernization Budget Estimates and Plans Raises Affordability Concerns

In April 2017, we issued our latest report on NNSA's 25-year plans to modernize the nation's nuclear weapons stockpile and its supporting infrastructure.[6] In this report, we identified two areas of misalignment between NNSA's modernization plans and the estimated budgetary resources needed to carry out those plans, which could result in challenges to NNSA in affording its planned portfolio of modernization programs. First, we found that NNSA's estimates of funding needed for its modernization plans sometimes exceeded the budgetary projections included in the President's planned near- and long-term modernization budgets. In the near-term (fiscal years 2018 through 2021), we found that NNSA may have to defer certain modernization work beyond that time period in order to execute its program within the planned budget, which could increase modernization costs and schedule risks. This is a pattern we have previously identified as a "bow wave"—an increase in future years' estimated budget needs that occurs when agencies are undertaking more programs than their resources can support. In the long-term (fiscal years 2022 through 2026), we found that NNSA's modernization program budget estimates sometimes exceeded the projected budgetary resources planned for inclusion in the President's budget, raising additional questions about whether NNSA will be able to afford the scope of its modernization program. Second, the costs of some major modernization programs—such as for nuclear weapon refurbishments—may also increase and further strain future modernization budgets.

Misalignment between Estimates and Plans May Result in Increased Cost and Schedule Risks and Raises Affordability Concerns

As we reported in April 2017, NNSA estimates of funding needed for its modernization plans sometimes exceeded the budgetary projections included in the President's planned near- and long-term modernization budgets.

[6]GAO, *National Nuclear Security Administration: Action Needed to Address Affordability of Nuclear Modernization Programs*, GAO-17-341 (Washington, D.C.: Apr. 26, 2017).

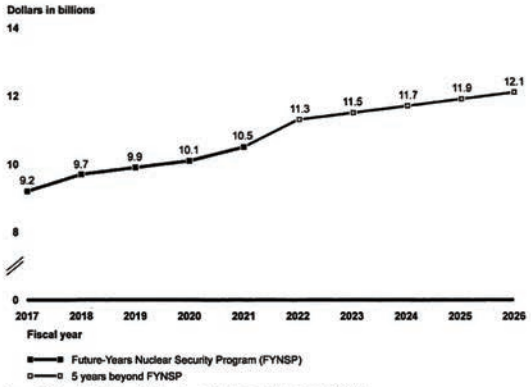
Near-term Misalignment between Modernization Plans and Estimated Budgetary Resources

We found that NNSA may have to defer certain modernization work planned for fiscal years 2018 through 2021 beyond its current 5-year planning period, called the Future-Years Nuclear Security Program (FYNSP). As we reported in April 2017, this is caused by a misalignment between NNSA's budget estimates for certain nuclear modernization programs and the President's budgets for that period.[7] We concluded that this deferral could exacerbate a significant bow wave of modernization funding needs that NNSA projects for the out-years beyond the FYNSP and could potentially increase modernization costs and schedule risks. As we have previously reported, such bow waves occur when agencies defer costs of their programs to the future, beyond their programming periods, and they often occur when agencies are undertaking more programs than their resources can support.[8] As NNSA's fiscal year 2017 budget materials show, its modernization budget estimates for fiscal years 2022 through 2026—the first 5 years beyond the FYNSP—may require significant funding increases. For example, in fiscal year 2022, NNSA's estimates of its modernization budget needs are projected to rise about 7 percent compared with the budget estimates for fiscal year 2021, the last year of the FYNSP, as shown in figure 1.

[7]Two key documents, updated annually, describe NNSA's operations, modernization plans, and budget estimates for implementing these plans; these documents comprise NNSA's nuclear security budget materials. First, the *Stockpile Stewardship and Management Plan* (the plan) is NNSA's formal means of communicating to Congress information on modernization and operations plans and budget estimates over the next 25 years. Second, NNSA's annual justification of the President's budget provides program information and budget estimates for the next 5 years. This 5-year plan is called the Future-Years Nuclear Security Program (FYNSP), and the budget estimates in this plan reflect funding levels approved by the Office of Management and Budget (OMB). The budget estimates for years included in the FYNSP must align with the 5-year overall federal budget estimates in the President's budget. The budget estimates for years beyond the FYNSP are not subject to this requirement.

[8]GAO, *Orion Multi-Purpose Crew Vehicle: Action Needed to Improve Visibility into Cost, Schedule, and Capacity to Resolve Technical Challenges*, GAO-16-620 (Washington, D.C.: Jul. 27, 2016) and *Weapon System Acquisitions: Opportunities Exist to Improve the Department of Defense's Portfolio Management*, GAO-15-466 (Washington, D.C.: Aug. 27, 2015).

Figure 1: Comparison of the National Nuclear Security Administration's Fiscal Year 2017 Budget Estimates for the Future-Years Nuclear Security Program and 5 Years Beyond



Source: GAO analysis of National Nuclear Security Administration data. | GAO-17-651T

Note: Amounts are presented in nominal dollars, which are not adjusted for the effects of inflation.

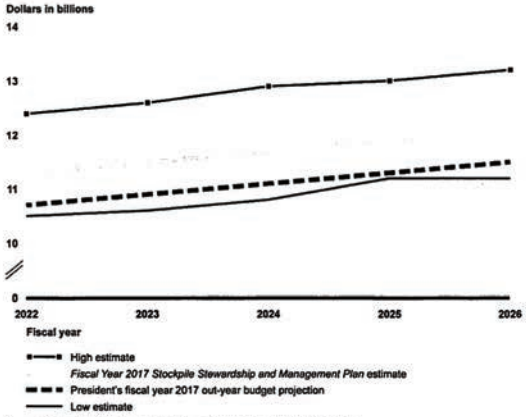
The analysis in our April 2017 report showed that NNSA has shifted this modernization bow wave to the period beyond the FYNSP time frame in each of the past four versions of the annual *Stockpile Stewardship and Management Plan*. For example, in the *Fiscal Year 2014 Stockpile Stewardship and Management Plan,* NNSA's budget estimates for its modernization programs increased from a total of about $9.3 billion in fiscal year 2018, the last year of the FYNSP, to about $10.5 billion in fiscal year 2019, the first year after the FYNSP—an increase of about 13 percent. Similar patterns showing a jump in funding needs immediately after the last year of the FYNSP are repeated in the funding profiles contained in the fiscal year 2015, 2016, and 2017 plans. As we have previously reported, deferring more work to future years can increase cost and schedule risks and can put programs in the position of potentially facing a backlog of deferred work that grows beyond what can be accommodated in future years.

Long-term Misalignment between Modernization Plans and Estimated Budgetary Resources

The *Fiscal Year 2017 Stockpile Stewardship and Management Plan* shows that NNSA's overall modernization budget estimates for fiscal years 2022 through 2026—the out-years beyond the FYNSP—may exceed the projected funding levels in the President's budgets for that time period, raising further questions about the affordability of NNSA's nuclear modernization plans. According to NNSA's data, the agency's estimated budget needed to support modernization totals about $58.4 billion for fiscal years 2022 through 2026, and the out-year funding projections contained in the President's fiscal year 2017 budget for the same period total about $55.5 billion. The President's out-year funding projections, therefore, are approximately $2.9 billion, or about 5.2 percent, less than NNSA estimates it will need over the same time period.

Despite this potential shortfall, NNSA's *Fiscal Year 2017 Stockpile Stewardship and Management Plan* concludes that the modernization program is generally affordable in the years beyond the FYNSP for two reasons. First, the President's out-year funding projections are sufficient to support NNSA's low-range cost estimates for its modernization programs for fiscal years 2022 through 2026. Based on NNSA data, the low-range cost estimates for fiscal years 2022 through 2026 total approximately $54.4 billion and the President's out-year funding projections total about $55.5 billion. Figure 2 illustrates data from the 2017 plan showing NNSA's nominal budget estimates, including high- and low-range cost estimates for its modernization program, along with the out-year funding projections from the President's fiscal year 2017 budget, for fiscal years 2022 to 2026. Second, NNSA concludes that its modernization programs are generally affordable beyond the FYNSP because the agency's estimated modernization budget needs will begin to decrease in fiscal year 2027.

Figure 2: Comparison of the Fiscal Year 2017 Stockpile Stewardship and Management Plan's Budget Estimates and High- and Low-Range Cost Estimates with the President's Fiscal Year 2017 Out-Year Budget Projections, Fiscal Years 2022 through 2026



Source: GAO analysis of National Nuclear Security Administration data. | GAO-17-651T

Note: Amounts are presented in nominal dollars, which are not adjusted for the effects of inflation.

In our April 2017 report, we noted that NNSA's conclusion—that its modernization program is affordable because the President's out-year funding projections fall within NNSA's modernization cost ranges—is overly optimistic. This is because NNSA's conclusion is predicated on optimistic assumptions regarding the cost of the modernization program beyond the FYNSP, particularly for fiscal years 2022 through 2026. For the program to be affordable, NNSA's modernization programs would need to be collectively executed at the low end of their estimated cost ranges. The plan does not discuss any options NNSA would pursue to support or modify its modernization program if costs exceeded its low-range cost estimates. In addition, the *Fiscal Year 2017 Stockpile Stewardship and Management Plan* states that the nominal cost of NNSA's modernization program is expected to decrease by approximately $1 billion in fiscal year 2027. In that year, according to the

2017 plan, it is anticipated that NNSA's estimated budgets for its modernization program will begin to fall in line with projections of future presidential budgets. However, as we noted in our April 2017 report, the decrease that NNSA anticipates in its modernization funding needs beginning in fiscal year 2027 may not be achievable if the projected mismatch between NNSA's estimates of its modernization budget needs and the projections of the President's modernization budget for fiscal years 2022 through 2026 is not resolved. This mismatch creates concerns that NNSA will not be able to afford planned modernization costs during fiscal years 2022 through 2026 and will be forced to defer them to fiscal year 2027 and beyond, continuing the bow wave patterns discussed above.

Potential Rising Costs of Some Modernization Programs May Further Strain NNSA's Modernization Budgets

Our April 2017 report identified misalignment between NNSA's estimate of its budget needs and NNSA's internal cost range estimates for several of its major modernization programs. Further, we found that the costs of some major life extension programs (LEPs) may increase in the future, which may further strain NNSA's planned modernization budgets.

With respect to the alignment of NNSA's estimate of its budget needs and NNSA's internal cost range estimates, we found that NNSA's budget estimates were generally consistent with NNSA's high- and low-range cost estimates.[9] However, for some years, NNSA's low-range cost estimates exceeded the budget estimates for some of the programs, suggesting the potential for a funding shortfall for those programs in those years. Specifically, we found that the low-range cost estimates for the W88 Alteration 370 program and all LEPs discussed in our April 2017

[9]According to NNSA officials, two approaches are used to estimate the costs of the LEPs, except for the W76-1. Under the first approach, according to officials, NNSA develops specific budget estimates by year through a "bottom-up" process. NNSA officials described this as a detailed approach to developing the LEP budget estimates that, among other things, integrates resource and schedule information from site participants. Under the second approach, which NNSA refers to as a "top-down" process, NNSA uses historical LEP cost data and complexity factors to project high and low cost ranges for each LEP distributed over the life of the program using an accepted cost distribution method. According to NNSA, the W76-1 LEP, which is the only weapon program that has been through the development phase and the majority of the production phase, is used as the primary basis for modeling cost ranges for all future LEPs. NNSA does not prepare high- and low-range cost estimates for it. Officials noted that the values in these cost ranges reflect idealized funding profiles and do not account for the actual detailed schedule of program activities, planning for risk in the project, or the results of execution to date.

report exceeded their budget estimates for some fiscal years within the 10-year time period from fiscal year 2017 to 2026.[10] As we reported in the 2013 and 2016, this misalignment indicates that NNSA's estimated budgets may not be sufficient to fully execute program plans and that NNSA may need to increase funding for these programs in the future.[11]

Additionally, we found that the costs of two ongoing nuclear weapon LEPs and the W88 Alteration 370 program may increase in the future, based on NNSA information that was produced after the release of the fiscal year 2017 budget materials.[12] These potential cost increases could further challenge the extent to which NNSA's budget estimates support the scope of modernization efforts. The LEPs facing potential cost increases include:

- **B61-12 LEP.** An independent cost estimate for the program completed in October 2016 exceeded the program's self-conducted cost estimate (conducted in June 2016) by $2.6 billion. We are conducting ongoing work to determine how NNSA has, if at all, reconciled this difference.
- **W80-4 LEP.** Officials from NNSA's Office of Cost Policy and Analysis told us that this program may be underfunded by at least $1 billion to meet the program's existing schedule.
- **W88 Alteration 370.** According to officials from NNSA's Office of Cost Policy and Analysis, this program's expanded scope of work may result in about $1 billion in additional costs.

To help NNSA put forth more credible modernization plans, we recommended in our April 2017 report that the NNSA Administrator include an assessment of the affordability of NNSA's portfolio of modernization programs in future versions of the *Stockpile Stewardship and Management Plan,* such as by presenting options (e.g., potentially deferring the start of or canceling specific modernization programs) that

[10]See GAO-17-341 for greater detail on these and other examples.

[11]GAO, *Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Increased but May Not Align with All Anticipated Costs*, GAO-16-290 (Washington, D.C.: Mar. 4, 2016) and *Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Do Not Fully Align with Plans*, GAO-14-45 (Washington, D.C.: Dec. 11, 2013).

[12]NNSA's fiscal year 2017 budget materials include two key documents: the *Fiscal Year 2017 Stockpile Stewardship and Management Plan*, which was issued in March 2016, and the agency's annual justification of the President's budget, which was issued in February 2016.

NNSA could consider taking to bring its estimates of modernization funding needs into alignment with potential future budgets. In commenting on our report, NNSA neither agreed nor disagreed with our recommendation.

DOE Has Taken Steps to Improve Contract and Project Management, but Challenges Persist, Particularly in Contract Management

The Secretary of Energy has taken several important steps that demonstrate DOE's commitment to improving contract and project management. In our recent reports, we have noted progress as DOE has developed and implemented corrective actions to identify and address root causes of persistent project management challenges, as well as progress in the department's monitoring of the effectiveness and sustainability of corrective actions. However, DOE's recent efforts have not fully addressed several areas where the department continues to have shortcomings.

DOE Has Made Progress in Contract and Project Management

As we noted in our 2017 high risk report, DOE has taken several important steps that demonstrate its commitment to improving project management—steps that have been supported by senior leadership within the department.[13] Specifically, based in part on our December 2014 recommendation,[14] DOE issued a revised project management order, DOE Order 413.3B, in May 2016 and added the following requirements for its program offices:

- Develop cost estimates in accordance with industry best practices.
- Conduct analyses of alternatives for projects consistent with industry best practices and independent of the contractor organization responsible for managing the construction or constructing a capital asset project.
- Ensure that major projects' designs and technologies are sufficiently mature before contractors are allowed to begin construction.

[13]GAO-17-317.

[14]GAO, *DOE and NNSA Project Management: Analysis of Alternatives Could Be Improved by Incorporating Best Practices*, GAO-15-37 (Washington, D.C.: Dec. 11, 2014).

- Conduct a root cause analysis if a major project is expected to exceed its approved cost or schedule.

DOE also made significant efforts to monitor the effectiveness and sustainability of corrective actions address project management challenges. For example, the Secretary strengthened the Energy Systems Acquisition Advisory Board by changing it from an ad hoc body to an institutionalized board responsible for reviewing all capital asset projects with a total project cost of $100 million or more. The Secretary also created the Project Management Risk Committee, which includes senior DOE officials and is chaired by a new departmental position—the Chief Risk Officer. The committee is chartered to assess the risks of projects across DOE and advise DOE senior leaders on cost, schedule, and technical issues for projects.[15]

Although DOE has taken these important actions, it is too early to tell whether front-end planning problems persist. DOE has previously acknowledged its longstanding problems with front-end planning, stating that insufficient front-end planning has consistently contributed to DOE projects not finishing on budget or schedule. Our recent work also indicates that continued senior-level attention on front-end planning may be warranted.

- In August 2016, we found problems with DOE's front-end project planning at the Waste Isolation Pilot Plant (WIPP) for the new permanent ventilation system.[16] This system is being built to enable DOE to resume full operations of the geological nuclear waste repository, which were suspended after a radiological release accident in February 2014. DOE did not follow all best practices in analyzing and selecting an alternative for the new ventilation system at WIPP, which DOE estimated will cost between $270 million and

[15]As we stated in our 2017 High Risk List update, additional time is needed for us to assess how effectively these recent monitoring improvements will validate the sustainability of corrective measures. We have not yet evaluated the operations of the newly created Project Management Risk Committee. In addition, DOE's new oversight and monitoring efforts are not comprehensive, as certain activities within EM are not subject to review by the committee, even though together they cost billions of dollars and last for numerous years. Finally, the effectiveness of DOE's monitoring of its contracts, projects, and programs depends upon the availability of reliable enterprise-wide cost information on which to base oversight activities. See: GAO-17-317.

[16]GAO, *Nuclear Waste: Waste Isolation Pilot Plant Recovery Demonstrates Cost and Schedule Requirements Needed for DOE Cleanup Operations*, GAO-16-608 (Washington, D.C.: Aug. 4, 2016).

$398 million to build and will be completed by the end of March 2021. For example, DOE did not select the preferred alternative based on assessing the difference between the life-cycle costs and benefits of each alternative, as called for by best practices and now required by DOE's revised project management order. We recommended that DOE require projects, including the WIPP ventilation system, to implement recommendations from independent analysis of alternatives reviews or document the reasons for not doing so. DOE concurred with the recommendation and planned to incorporate guidance in its updated project review guide on how DOE offices should address recommendations from independent reviews.

- In August 2016, we found that DOE did not follow project management requirements in its front-end planning for an alternative to the Chemistry and Metallurgy Research Replacement (CMRR) project.[17] After spending $450 million designing the project, NNSA reversed its decision to build a large nuclear facility because of projected excessive cost growth. Instead, NNSA revised the CMRR project to use existing and smaller new facilities. We found that NNSA did not define key parameters for one aspect of the new project, including the capacity for analyzing plutonium that the project should provide, as directed by NNSA policy. We made several recommendations, including that NNSA identify the capacity for analyzing plutonium for the revised CMRR project. NNSA neither agreed nor disagreed with the recommendations.

Areas Where Challenges Continue to Persist

DOE's recent efforts do not address several areas where it continues to have shortcomings including (1) acquisition planning for its major contracts, (2) the quality of enterprise-wide cost information available to DOE managers and key stakeholders, (3) DOE's need for a program management policy, (4) how DOE's new project management requirements will be applied to its major legacy projects, and (5) whistleblower protections.

Acquisition Planning for Major Contracts

During the acquisition planning phase for contracts, critical contract decisions are made that have significant implications for the cost and overall success of an acquisition. In August 2016, we examined DOE's use of management and operating (M&O) contracts.[18] We found that DOE

[17]GAO, *DOE Project Management: NNSA Needs to Clarify Requirements for its Plutonium Analysis Project at Los Alamos,* GAO-16-585 (Washington, D.C.: Aug. 9, 2016).

[18]GAO, *Department of Energy: Actions Needed to Strengthen Acquisition Planning for Management and Operating Contracts,* GAO-16-529 (Washington, D.C.: Aug. 9, 2016).

did not consider acquisition alternatives beyond continuing its longstanding M&O contract approach for 16 of its 22 M&O contracts. We concluded that without considering broader alternatives in the acquisition planning phase, DOE cannot ensure that it is selecting the most effective scope and form of contract, raising risks for both contract cost and performance.

The size and duration of DOE's M&O contracts—22 M&O contracts with an average potential duration of 17 years, representing almost three-quarters of DOE's spending in fiscal year 2015—underscore the importance of planning for every M&O acquisition. According to DOE officials, one of the primary reasons DOE uses this type of contract is because it is less burdensome to manage. According to DOE officials, such contracts are easier to manage with fewer DOE personnel because they are less frequently competed and have broadly written scopes of work, among other attributes. Moreover, a 2013 study found that, on average, each NNSA M&O procurement employee was associated with about $287 million in contract spending, compared with a federal government average of $9 million per procurement employee. We made two recommendations in that report, including that DOE establish a process to analyze and apply its experience with contracting alternatives. DOE generally concurred with our recommendations.

Quality of Enterprise-Wide Information

The effectiveness of DOE's monitoring of its contracts, projects, and programs depends upon the availability of reliable enterprise-wide information on which to base oversight activities. For example, reliable enterprise-wide cost information is needed to identify the cost of activities, ensure the validity of cost estimates, and provide information to Congress to make budgetary decisions. However, meaningful cost analyses across programs, contractors, and sites are not possible because NNSA's contractors use different methods of accounting for and tracking costs. NNSA developed a plan to improve and integrate its cost reporting structures; however, we found in our January 2017 report that this plan did not provide a useful road map for guiding NNSA's effort.[19] For example, NNSA did not define strategies and identify resources needed to achieve its goals, which is a leading practice for strategic planning. NNSA's plan contained few details on the elements it must include, such

[19]GAO, *National Nuclear Security Administration: A Plan Incorporating Leading Practices Is Needed to Guide Cost Reporting Improvement Effort*, GAO-17-141 (Washington, D.C.: Jan. 19, 2017).

as its feasibility assessment, estimated costs, expected results, and an implementation timeline. We concluded that, until a plan is in place that incorporates leading strategic planning practices, NNSA cannot be assured that its efforts will result in a cost collection tool that produces reliable enterprise-wide cost information that satisfies the information needs of Congress and program managers. We recommended that NNSA develop a plan for producing cost information that fully incorporates leading planning practices. NNSA agreed with our recommendation.

In addition, quality data is needed for DOE to manage its risk of fraud. The Fraud Reduction and Data Analytics Act of 2015 establishes requirements aimed at improving federal agencies' controls and procedures for assessing and mitigating fraud risks through the use of data analytics. In our March 2017 report, however, we found that because DOE does not require its contractors to maintain sufficiently detailed transaction-level cost data that are reconcilable with amounts charged to DOE, it is not well positioned to employ data analytics as a fraud detection tool.[20] The data were not suitable either because they were not for a complete universe of transactions that was reconcilable with amounts billed to DOE or because they were not sufficiently detailed to determine the nature of costs charged to DOE. We concluded that, without requiring contractors to maintain such data, DOE will not be well positioned to meet the requirements of the Fraud Reduction and Data Analytics Act of 2015 and manage its risk of fraud and other improper payments. We recommended that DOE require contractors to maintain sufficiently detailed transaction-level cost data that are reconcilable with amounts charged to the government. DOE did not concur with our recommendation. Specifically, DOE stated that the recommendation establishes agency-specific requirements for DOE contractors that are more prescriptive than current federal requirements and that its M&O contractors, not DOE, are responsible for performing data analytics and determining what data are needed to do so. We are concerned that DOE's response demonstrates that it does not fully appreciate its responsibility for overseeing contractor costs. We continue to believe that the use of data-analytic techniques by DOE employees could help mitigate some of the challenges that limit the effectiveness of DOE's approach for overseeing M&O contractor costs. However, effectively

[20]GAO, *Department of Energy: Use of Leading Practices Could Help Manage the Risk of Fraud and Other Improper Payments*, GAO-17-235 (Washington, D.C.: Mar. 30, 2017).

applying data-analytics is dependent upon the availability of complete and sufficiently detailed contractor data. Therefore, we continue to believe that DOE needs to implement our recommendation and require contractors to maintain sufficiently detailed transaction-level cost data that are reconcilable with amounts charged to the government.

Program Management

Program management can help ensure that a group of related projects and activities are managed in a coordinated way to obtain benefits not available from managing them individually. This approach helps federal agencies get what they need, at the right time, and at a reasonable price. However, in 2016 we found that DOE had not established a department-wide program management policy and that DOE had not established a career development program for program managers. Specifically,

- In an August 2016 report examining NNSA's plans to build the CMRR, we found that the agency had not clarified whether the project would satisfy the mission needs of other NNSA and DOE programs.[21] NNSA might have been better able to clarify this project's mission needs if DOE and NNSA had been operating under a DOE-wide program management policy incorporating leading practices. DOE and NNSA officials said they recognize the importance of establishing a program management policy, but at the time DOE had not done so. We recommended that DOE establish a program management policy that addresses internal control standards and leading practices. DOE provided no comments on our recommendation. After we issued our report, the President signed the 2016 Program Management Improvement Accountability Act, which requires the development of standards, policies, and guidelines for program and project management across the federal government. We will continue to monitor and report on the Act's implementation as part of our biennial high risk updates, and we will also include an assessment of the effectiveness of the standards, policies, and guidelines that are to be developed.
- In a November 2016 report, we found that DOE and NNSA had not established training programs, such as a career development program, for program managers.[22] Program managers are responsible for interacting with project managers to provide support

[21]GAO-16-585.

[22]GAO, *Program Management: DOE Needs to Develop a Comprehensive Policy and Training Program*, GAO-17-51. (Washington, D.C.: Nov. 21, 2016).

and guidance on individual projects, but they also must take a broad view of program objectives and organizational culture. In contrast, DOE had established a training program for project managers, which DOE said was open to program managers. In the absence of a current DOE or NNSA training program for program managers, most of the NNSA program managers we interviewed did not have training related to program management. As a result, we concluded that NNSA may have difficulty developing and maintaining a cadre of professional, effective, and capable program managers. We recommended that DOE establish a training program for program managers.[23] DOE provided no comments on this report.

Major Legacy Projects

DOE has instituted project management reforms that—if fully implemented—will help ensure that future projects are not affected by the challenges that have persisted for DOE's major legacy projects. Specifically, DOE has taken action on certain major projects, but has not consistently applied these reforms, and in particular, DOE has not applied such reforms to its largest legacy cleanup project at its Hanford Site in Washington state. As we found in a May 2015 report, DOE continues to allow construction of certain Waste Treatment and Immobilization Plant (WTP) facilities at DOE's Hanford Site before designs are 90 percent complete.[24] This contrasts with DOE's revised project management order that now requires a facility's design to be at least 90 percent complete before establishing cost and schedule baselines and cost and schedule estimates that meet industry best practices. The WTP is DOE's largest project, and it has faced numerous technical and management challenges that have added decades to its schedule and billions of dollars to its cost. We recommended in May 2015 that DOE (1) consider whether to limit construction on the WTP until risk mitigation strategies are developed to address known technical challenges, and (2) determine the extent to which the quality problems exist, in accordance with its quality assurance policy, for the facilities' systems that have not been reviewed to determine if additional vulnerabilities exist. However, as of September 2016, DOE has not yet implemented our recommendations. Notably, after we issued our report, DOE announced in December 2016 that the cost estimate for

[23]As noted above, the Program Management Improvement Accountability Act may help NNSA address some of its challenges in program management.

[24]The WTP is DOE's current planned approach to treating some of Hanford's radioactive tank waste. See: GAO, *Hanford Waste Treatment: DOE Needs to Evaluate Alternatives to Recently Proposed Projects and Address Technical and Management Challenges*, GAO-15-354 (Washington, D.C.: May 7, 2015).

one portion of the WTP—the part needed to treat a fraction of the low-activity waste—had increased to nearly $17 billion. This cost estimate does not include the costs for a majority of the WTP's waste treatment scope, including high-level waste treatment. In light of longstanding challenges with major projects, such as with the WTP, we believe DOE must begin to apply project management reforms to the projects that need them the most.[25]

Whistleblower Protections

Having the right people and resources is necessary to mitigate risks, but it is not always sufficient to ensure that risks are identified and appropriately addressed. As we have previously reported, management must foster a culture in which staff are encouraged to identify risks and use their expertise to proactively mitigate them. In July 2016, we examined DOE's effort to evaluate the environment for raising concerns without fear of reprisal.[26] We found, among other things, that DOE used flawed and inconsistent methodologies to evaluate the environment for raising safety and other concerns and therefore could not reliably judge its openness or ensure that appropriate action was taken in response to evaluation results. We noted that several factors may limit the use and effectiveness of mechanisms for contractor employees to raise concerns and seek whistleblower protections. We also found that DOE infrequently used its enforcement authority to hold contractors accountable for unlawful retaliation against whistleblowers, issuing just two violation notices in the past 20 years. Additionally, in 2013, DOE determined that it did not have the authority to enforce a key aspect of policies that prohibit retaliation for nuclear safety-related issues—despite having taken such enforcement actions in the past.[27] In response to our recommendations, DOE has

[25]We have ongoing work examining the Mixed Oxide Fuel Fabrication Facility, the Uranium Processing Facility, and the Waste Treatment and Immobilization Plant.

[26]GAO, *Department of Energy: Whistleblower Protections Need Strengthening*, GAO-16-618 (Washington, D.C.: July 11, 2016).

[27]We made several recommendations, including that DOE independently assess the environment for raising concerns, evaluate whether the whistleblower pilot program will mitigate challenges with the existing program, expedite time frames for clarifying regulations, and clarify policies to hold contractors accountable. DOE concurred with most of these recommendations. In December 2016, DOE issued a rule to change DOE's nuclear safety rules to clarify its authority to assess civil penalties against certain contractors and subcontractors for violating the prohibition against retaliating against whistleblowers. In addition, in September 2016, DOE updated its Order 221.1B that establishes the requirements and responsibilities for reporting fraud, waste, and abuse. The revised order provides some additional specificity to its Office of Inspector General's role in processing employee allegations and provides additional language intended to prohibit contractors from deterring or dissuading employees from reporting concerns.

started the process of updating its Integrated Safety Management policies and guidance, but it is too early to tell whether the updated regulation will address the concerns we raised in our July 2016 report.

DOE Annually Spends Billions on Environmental Cleanup, but the Cost of Its Liabilities Continues to Increase

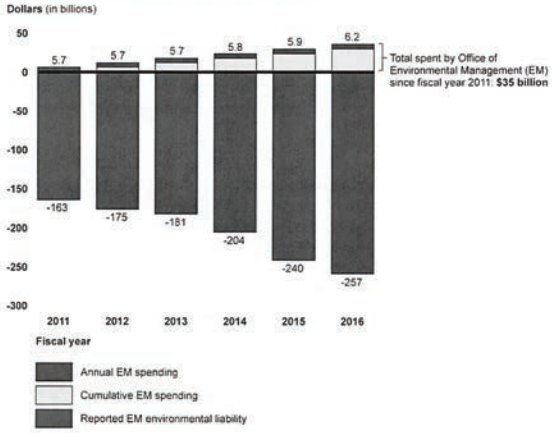
DOE also faces challenges with addressing its environmental liabilities. In February 2017, we added the federal government's environmental liabilities to our High-Risk List. Specifically, we found that the federal government's environmental liability has been growing for the past 20 years—and is likely to continue to increase—and that DOE is responsible for over 80 percent ($372 billion) of the nearly $450 billion reported environmental liability.[28] Notably, this estimate does not reflect all of the future cleanup responsibilities that DOE may face. In addition, DOE has not consistently taken a risk-informed approach to decision-making for environmental cleanup, and DOE may therefore be missing opportunities to reduce costs while also reducing environmental risks more quickly. Our recent work in this area has also identified opportunities where DOE may be able to save tens of billions of dollars. [29]

DOE's total reported environmental liability has generally increased over time. Since 1989, EM has spent over $164 billion to retrieve, treat, and dispose of nuclear and hazardous waste and to date has completed cleanup at 91 of 107 sites across the country (the 91 sites were generally viewed by DOE as the smallest and least contaminated sites to address). Despite billions spent on environmental cleanup, DOE's environmental liability has roughly doubled from a low of $176 billion in fiscal year 1997 to the fiscal year 2016 estimate of $372 billion. In the last 6 years alone, EM has spent $35 billion, primarily to treat and dispose of nuclear and hazardous waste and construct capital asset projects to treat the waste (see figure 3 for EM's annual spending and growing environmental liability). According to documents related to DOE's fiscal year 2016 financial statements, 50 percent of DOE's environmental liability resides at two cleanup sites: the Hanford Site in Washington State and the Savannah River Site in South Carolina.

[28]The majority of DOE's annual environmental cleanup funding—over 80 percent in fiscal year 2016—comes from annual defense authorization spending.

[29]Federal accounting standards require agencies responsible for cleaning up contamination to estimate future cleanup and waste disposal costs and to report such costs in their annual financial statements as environmental liabilities. Per federal accounting standards, federal agencies' environmental liability estimates are to include probable and reasonably estimable costs of cleanup work.

Figure 3: Department of Energy's Office of Environmental Management's Annual Spending and Growing Environmental Liability



Source: GAO analysis of Department of Energy budget data. | GAO-17-651T

Note: EM is the organization within the Department of Energy responsible for managing environmental cleanup and is responsible for cleaning up 107 sites across the country. To date, EM has completed cleanup at 91 of these sites. EM spending includes money to treat and dispose of nuclear and hazardous waste and to construct capital asset projects to treat the waste. We did not adjust environmental liability estimates for inflation because information about the amount of the liability applicable to each future fiscal year was not available.

In its fiscal year 2016 financial statement, DOE attributed recent environmental liability increases to (1) inflation adjustments for the current year; (2) improved and updated estimates for the same scope of work, including changes resulting from deferral or acceleration of work; (3) revisions in technical approach or scope for cleanup activities; and (4) regulatory and legal changes. Notably, in recent annual financial reports, DOE has cited other significant causes for increases in its liability. Other causes have included the lack of a disposal path for high-level radioactive waste—because of the termination of the Yucca Mountain repository

program —and delays and scope changes for major construction projects at the Hanford and Savannah River sites.[30]

We also reported in February 2017 that DOE's estimated liability does not include billions in expected costs.[31] According to federal accounting standards, environmental liability estimates should include costs that are probable and reasonably estimable, meaning that costs that cannot yet be reasonably estimated should not be included in total environmental liability.[32] Examples of costs that DOE cannot yet estimate include the following:

- DOE has not yet developed a cleanup plan or cost estimate for the Nevada National Security Site and, as a result, the cost of future cleanup of this site was not included in DOE's fiscal year 2015 reported environmental liability. The nearly 1,400-square-mile site has been used for hundreds of nuclear weapons tests since 1951. These activities have resulted in more than 45 million cubic feet of radioactive waste at the site. According to DOE's financial statement, since DOE is not yet required to establish a plan to clean up the site, the costs for this work are excluded from DOE's annually reported environmental liability.
- DOE's reported environmental liability includes an estimate for the cost of a permanent nuclear waste repository, but these estimates are highly uncertain and likely to increase. In March 2015, in response to the termination of the Yucca Mountain repository program, DOE proposed separate repositories for defense high-level and commercial waste. In January 2017, we reported that the cost estimate for DOE's

[30]In June 2008, DOE submitted a license application to the NRC seeking authorization to construct a high-level nuclear waste repository at Yucca Mountain. In the application, DOE stated that it planned to open the repository in 2017. DOE later delayed the date to 2020. In March 2009, however, the Secretary of Energy announced plans to terminate the Yucca Mountain repository program and instead study other nuclear waste options. The President's fiscal year 2011 budget proposal, released in February 2010, proposed eliminating all funding for the Yucca Mountain repository program. For more information, see GAO, *Commercial Nuclear Waste: Effects of a Termination of the Yucca Mountain Repository Program and Lessons Learned,* GAO-11-229 (Washington, D.C.: Apr. 8, 2011).

[31]GAO-17-317.

[32]Federal Accounting Standards Advisory Board, *FASAB Handbook of Federal Accounting Standards and Other Pronouncements, as Amended* (Washington, D.C.: June 30, 2016).

new approach excluded the costs and time frames for key activities.[33] As a result, the full cost of these activities is likely billions of dollars more than what is reflected in DOE's environmental liability. In our annual report on Fragmentation, Overlap, and Duplication in the federal government that we issued in May 2017, we reported that DOE may be able to save billions of dollars by reassessing the rationale for its March 2015 proposal.[34] In April 2017, the House of Representatives Committee on Energy and Commerce disseminated a discussion draft of legislation that could result in renewed efforts to open the Yucca Mountain repository.[35]

In addition, DOE may have insufficient controls in place to accurately account for its environmental liabilities. In January 2017, the DOE Inspector General reported a significant deficiency in internal controls related to the reconciliation of environmental liabilities.

Moreover, DOE does not consistently take a risk-informed decision-making approach to its environmental cleanup mission to more efficiently use resources. As our and other organizations' reports issued over the last 2 decades have found, DOE's environmental cleanup decisions have not been risk-based, and there have been inconsistencies in the regulatory approaches followed at different sites. We and others have pointed out that DOE needs to take a nation-wide, risk-based approach to cleaning up these sites, which could reduce costs while also reducing environmental risks more quickly.

- In 2006, the National Research Council reported that the nation's approach to cleaning up nuclear waste—primarily carried out by DOE—was complex, inconsistent, and not systematically risk-based.[36] For example, the National Research Council noted that the current regulatory structure for low-activity waste is based primarily on the

[33]GAO, *Nuclear Waste: Benefits and Costs Should Be Better Understood Before DOE Commits to a Separate Repository for Defense Waste*, GAO-17-174 (Washington, D.C.: Jan. 31, 2017).

[34]GAO, *2017 Annual Report: Additional Opportunities to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits*, GAO-17-491SP (Washington, D.C.: Apr. 26, 2017).

[35]Nuclear Waste Policy Amendments Act of 2017, H.R. ___, 115th Cong. (2017).

[36]National Research Council of the National Academies, *Improving the Regulation and Management of Low-Activity Radioactive Wastes*, (Washington, D.C.: National Academies Press, 2006).

waste's origins rather than on its actual radiological risks. The National Research Council concluded that by working with regulators, public authorities, and local citizens to implement risk-informed practices, waste cleanup efforts can be done more cost-effectively. The report also suggested that statutory changes were likely needed.

- In 2015, a review organized by the Consortium for Risk Evaluation with Stakeholder Participation reported that DOE was not optimally using available resources to reduce risk.[37] According to the report, factors such as inconsistent regulatory approaches and certain requirements in federal facility agreements caused disproportionate resources to be directed at lower-priority risks. The report called for a more systematic effort to assess and rank risks within and among sites, including through headquarters guidance to sites, and to allocate federal taxpayer monies to remedy the highest priority risks through the most efficient means.
- In May 2017, we reported on DOE's efforts to treat a significant portion of the tank waste at the Hanford Site.[38] We found that DOE chose different approaches to treat the less radioactive portion of its tank waste—which DOE refers to as "low-activity waste" (LAW)—at the Hanford and Savannah River Sites. At the Savannah River Site, DOE has grouted about 4 million gallons of LAW since 2007. DOE plans to treat a portion of the Hanford Site's LAW with vitrification, but it has not has not yet treated any of Hanford's LAW and faces significant unresolved technical challenges in doing so.[39] In addition, we found that the best available information indicates that DOE's estimated costs to grout LAW at the Savannah River Site are substantially lower than its estimated costs to vitrify LAW at Hanford, and DOE may be able to save tens of billions of dollars by reconsidering its waste treatment approach for a portion of the LAW at Hanford. Moreover, according to the 21 experts that attended our

[37]The Consortium for Risk Evaluation with Stakeholder Participation is a multi-university consortium organized in 1995 that provides several types of independent, multi-disciplinary reviews of DOE documents, projects, and reports. See: Omnibus Risk Review Committee, *A Review of the Use of Risk-Informed Management in the Cleanup Program for Former Defense Nuclear Sites* (August 2015).

[38]About 90 percent of the waste at Hanford is considered to be low-activity, meaning that it is much less radioactive than high-level waste. See GAO, *Nuclear Waste: Opportunities Exist to Reduce Risks and Costs by Evaluating Different Waste Treatment Approaches at Hanford*, GAO-17-306 (Washington, D.C.: May 3, 2017).

[39]Grout immobilizes waste in a concrete-like mixture. Vitrification immobilizes waste in glass.

meeting convened by the National Academies of Sciences, Engineering, and Medicine, both vitrification and grout could effectively treat Hanford's LAW. Experts at our meeting also stated that developing updated information on the effectiveness of treating a portion of Hanford's waste, called supplemental LAW, with other methods, such as grout, may enable DOE to consider waste treatment approaches that would accelerate DOE's tank waste treatment mission, thereby potentially reducing certain risks and lifecycle treatment costs. We recommended that DOE (1) develop updated information on the performance of treating supplemental LAW with alternate methods, such as grout, before it selects an approach for treating supplemental LAW; and (2) have an independent entity develop updated information on the lifecycle costs of treating Hanford's supplemental LAW with alternate methods. DOE agreed with both recommendations.

Since 1994, we have made at least 28 recommendations related to addressing the federal government's environmental liability and 4 recommendations to Congress to consider changes to the laws governing cleanup activities. Of these, 13 recommendations remain unimplemented. If implemented, these steps would improve the completeness and reliability of the estimated costs of DOE's future cleanup responsibilities and lead to more risk-based management of the cleanup work. We believe these recommendations are as relevant, if not more so, today.[40]

[40]We have ongoing work examining the consistency of DOE's compliance agreements, looking specifically at the extent to which milestones within select compliance agreements are tailored to the environmental and human health risks that DOE is faced with addressing and the extent to which DOE's cleanup remedies are based on up-to-date assessments of conditions at sites and of DOE's technical capabilities.

NNSA Faces Nonproliferation Performance and Program Management Challenges

NNSA also faces challenges implementing its nonproliferation programs under its Office of Defense Nuclear Nonproliferation (DNN). Specifically, in recently completed reviews of DNN programs, we have identified several challenges NNSA faces in how it measures performance and conducts program management of these efforts.[41]

- As I testified last year,[42] NNSA proposed in its fiscal year 2017 congressional budget request to terminate its Mixed Oxide (MOX) Fuel Fabrication Facility, which has been under construction since 2007 and for which NNSA has already spent approximately $4.6 billion on design and construction.[43] NNSA's request stated that its MOX fuel approach for disposing of 34 tons of weapons-grade plutonium will be significantly more expensive than anticipated and will require approximately $800 million to $1 billion annually for decades. Instead, NNSA proposed to focus on a new alternative to dilute the surplus plutonium and dispose of the material in a geologic repository. We have ongoing work examining the MOX facility and the extent to which WIPP has sufficient capacity to dispose of this quantity of plutonium. Specifically, we are assessing the extent to which DOE's revised $17.2 billion cost estimate for completing construction of the MOX facility, and the $56 billion revised life-cycle estimate for completing the Plutonium Disposition Program using the MOX approach met cost-estimating best practices. In addition, we are examining the status of NNSA's development of a life-cycle cost estimate for completing the Plutonium Disposition Program using the dilute and dispose approach. Our review will also assess the extent to which DOE has sufficient disposal space and statutory capacity at WIPP to dispose of all defense transuranic waste, including the diluted plutonium resulting from the dilute and dispose approach.
- In June 2016, we found that the Nuclear Smuggling Detection and Deterrence (NSDD) program had developed a program plan, but that

[41]We have ongoing work on DNN program management practices and policy. Under this review we have conducted a preliminary assessment of the extent to which four selected DNN programs have established cost and schedule estimates and are measuring performance against cost and schedule baselines.

[42]GAO, *Department of Energy: Observations on Efforts by NNSA and The Office of Environmental Management to Manage and Oversee the Nuclear Security Enterprise*, GAO-16-422T (Washington, D.C., Feb. 23, 2016).

[43]The facility was to produce MOX fuel (i.e., a mix of plutonium and uranium oxides) for nuclear reactors.

NSDD could not measure its progress towards activities and goals because its goals were not all measurable and performance measures were not aligned with its goals.[44] Under this program, NSDD may not be able to determine when it has fully accomplished its mission and risks continuing to deploy equipment past the point of diminishing returns. NSDD also faces challenges in performing its work that are outside of its control, such as the changing conditions in partner countries from conflict or political upheaval. We recommended that NSDD develop a more detailed program plan that articulates when and how it will achieve its goals, including completing key activities such as the deployment of radiation detection equipment to partner countries and having these countries fully fund the sustainment and maintenance of this equipment. NNSA agreed with this recommendation.

- In February 2017, we found that NNSA was unable to demonstrate the full results of its research and development technology for preventing nuclear proliferation.[45] Specifically, we reported that DNN's Research and Development program does not consistently track and document projects that result in technologies being transitioned or deployed. Furthermore, we found that DNN's Research and Development project performance is difficult to interpret because the program's performance measures do not define criteria or provide context justifying how the program determined that it met its targets. This, in turn, could hinder users' ability to determine the program's progress. NNSA officials said that final project reports do not document their assessment of performance against baseline targets and that there is no common template for final project reports. We noted that documenting assessments that compare final project performance results against baseline targets for scope of work and completion date could enhance NNSA's ability to manage its programs in accordance with these standards. More consistently tracking and documenting the transitioned and deployed technologies that result from DNN's projects could also facilitate knowledge sharing

[44]GAO, *Combating Nuclear Smuggling: NNSA's Detection and Deterrence Program is Addressing Challenges but Should Improve Its Program Plan*, GAO-16-460 (Washington, D.C.: Jun. 17, 2016).

[45]GAO, *Nuclear Nonproliferation: Better Information Needed on Results of National Nuclear Security Administration's Research and Technology Development Projects*, GAO-17-210, (Washington, D.C.: Feb. 3, 2017). A transitioned technology is provided to users outside of the project team for further development or deployment. A deployed technology is one that is being actively used in the field by a federal agency or foreign partner.

within DNN, and would provide a means by which to present valuable information to Congress and other decision makers about the programs' results and overall value. We recommended that NNSA consistently track and document results of DNN Research and Development projects and document assessments of final project results against baseline performance targets. NNSA agreed to take actions in response to both recommendations.

Chair Fischer, Ranking Member Donnelly, and Members of the Subcommittee, this completes my prepared statement. I would be pleased to respond to any questions you may have at this time.

GAO Contact and Staff Acknowledgements

If you or your staff members have any questions about this testimony, please contact me at (202) 512-3841 or trimbled@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. GAO staff who made key contributions to this testimony are Nathan Anderson, Assistant Director; Allison Bawden; Natalie Block, Antoinette Capaccio; William Hoehn; Amanda Kolling; and Diane LoFaro.

Selected GAO Products

The following is a selection of GAO's recent work assessing the National Nuclear Security Administration's and the Department of Energy's Office of Environmental Management's management efforts:

Nuclear Waste: Opportunities Exist to Reduce Risks and Costs by Evaluating Different Waste Treatment Approaches at Hanford. GAO-17-306. Washington, D.C.: May 3, 2017.

National Nuclear Security Administration: Action Needed to Address Affordability of Nuclear Modernization Programs. GAO-17-341. Washington, D.C.: April 26, 2017.

Department of Energy: Use of Leading Practices Could Help Manage the Risk of Fraud and Other Improper Payments. GAO-17-235. Washington, D.C.: March 30, 2017.

Nuclear Nonproliferation: Better Information Needed on Results of National Nuclear Security Administration's Research and Technology Development Projects. GAO-17-210. Washington, D.C.: February 3, 2017.

Nuclear Waste: Benefits and Costs Should Be Better Understood Before DOE Commits to a Separate Repository for Defense Waste. GAO-17-174,.Washington, D.C.: January 31, 2017.

National Nuclear Security Administration: A Plan Incorporating Leading Practices Is Needed to Guide Cost Reporting Improvement Effort. GAO-17-141. Washington, D.C.: January 19, 2017.

Program Management: DOE Needs to Develop a Comprehensive Policy and Training Program. GAO-17-51. Washington, D.C.: November 21, 2016.

Department of Energy: Actions Needed to Strengthen Acquisition Planning for Management and Operating Contracts. GAO-16-529. Washington, D.C.: August 9, 2016.

DOE Project Management: NNSA Needs to Clarify Requirements for Its Plutonium Analysis Project at Los Alamos. GAO-16-585. Washington, D.C.: August 9, 2016.

Nuclear Waste: Waste Isolation Pilot Plant Recovery Demonstrates Cost and Schedule Requirements Needed for DOE Cleanup Operations. GAO-16-608. Washington, D.C.: August 4, 2016.

Department of Energy: Whistleblower Protections Need Strengthening. GAO-16-618. Washington, D.C.: July 11, 2016.

Combating Nuclear Smuggling: NNSA's Detection and Deterrence Program is Addressing Challenges but Should Improve Its Program Plan. GAO-16-460. Washington, D.C.: June 17, 2016.

Hanford Waste Treatment: DOE Needs to Evaluate Alternatives to Recently Proposed Projects and Address Technical and Management Challenges. GAO-15-354. Washington, D.C.: May 7, 2015.

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Strategic Planning and External Liaison	James-Christian Blockwood, Managing Director, spel@gao.gov, (202) 512-4707 U.S. Government Accountability Office, 441 G Street NW, Room 7814, Washington, DC 20548

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Senator FISCHER. Thank you, Director.

We will begin the first round of questioning, 7-minute rounds, please.

General Klotz, I appreciate the work that NNSA has done in tandem with Los Alamos to repurpose existing lab space and take initial steps to rebuild our pit production capacity. However, last year you testified before this subcommittee that additional capacity would be required and that the NNSA was conducting an analysis of alternatives to determine the Department's future plutonium strategy.

Can you tell me what the status is of that AOA [Analysis of Alternatives], please?

Secretary KLOTZ. Yes, ma'am. The AOA is still underway. We expect that it will be completed in the summer timeframe.

Senator FISCHER. Are there any additional studies that are going to be required, or do you expect the AOA to select a way forward and to allow us to move out on this?

Secretary KLOTZ. I expect the AOA will inform us as the way to go forward. Now, the AOAs themselves are not necessarily dispositive in terms of what the final outcome will be. They're designed to inform the decision-makers within NNSA and within the Department and the Congress as to what the various options are and what the various advantages and disadvantages of a particular option are.

Senator FISCHER. At this point, do you believe that that will be enough, that the AOA is going to be able to present options and that we're going to be able to move forward, or do you think there will be other studies required?

Secretary KLOTZ. Well, we will do other—as part of the process which Director Trimble, in fact, outlined, in several parts of it, we do analysis of alternatives, we do independent cost estimates, we examine the particular risks of the various ways forward. The first step in that process is to do an analysis of alternatives to know the places that we can go.

I'm glad you raised this because as a Nation we no longer have the capability to manufacture plutonium pits for our Nation's nuclear weapons stockpile, and the Congress has given us clear direction to rebuild that capability, and we are on track to be able to. In fact, this year we have already fabricated, Los Alamos has fabricated some development pits at Los Alamos. With this budget, if it's approved by the Congress, we'll fabricate 4 additional developmental pits, working our way towards the ability to do 10 pits in 2024, and then growing up to eventually get to the point where we'll be able to demonstrate the capacity to do 80 pits a year.

We can only do 30, we think, at the current facilities, which, as you rightly pointed out, we're repurposing Plutonium Facility 4, PF4, and in the radiation laboratory. We're going to need additional capacity, additional floor space to get from about the 30 level up to the 80 level. So that's why we're pursuing this analysis of alternatives to educate and inform us, inform decision-makers on the best option for achieving that capability.

Senator FISCHER. So as we look at the budget request that this subcommittee and the full committee is going to be receiving, will that give us that capacity to be able to reach that goal of 80, or are we going to have to address that in the future? Is it included in the budget request here, or are we going to be having this conversation again in the future?

Secretary KLOTZ. Well, we'll be having this conversation again in the future because our budget request for fiscal year 2018 is to pay for the program in fiscal year 2018. We do not have——

Senator FISCHER. Not the facilities.

Secretary KLOTZ. Well, the facilities, but also all the other things we need to do with our plutonium sustainment operations at Los Alamos and elsewhere. You will not see in this budget the FYNSP

numbers in great fidelity beyond this particular fiscal year request, and the reason for that, quite simply, is that with the new administration we are in the process of conducting a nuclear posture review, and the results of that nuclear posture review I think will be very important for what we have to fund and where the priorities will be in the years ahead.

Senator FISCHER. Are we looking at any funding wedges that have been built into this budget request to execute the path forward that's going to be determined by the AOA?

Secretary KLOTZ. I don't know that there are any wedges in there. I think the number that we have given you for fiscal year 2018 is what we need to cover the cost of that. I think last year we did have some wedges in there to indicate to the Congress that there would have to be some spending in that particular area. Remember, we don't baseline a program until we have gone through this very methodical process that Director Trimble laid out. So we're not at that point where we have the fidelity of numbers to say what it's going to be 2 years from now, 4 years from now, 5 years from now.

Senator FISCHER. So this wasn't a decision made by the OMB [Office of Management and Budget] or by the NNSA. It's just that you haven't reached that point yet where you can put it in?

Secretary KLOTZ. That's right. We have not reached that point on this particular aspect of the plutonium strategy.

Senator FISCHER. Okay. What does that mean about your request for the additional funding as we move through this process beyond the years, the out-years of this budget? Will that come to us later?

Secretary KLOTZ. It will. I think it will come in the fiscal year 2019 budget's mission, which we are already in the process of working.

Senator FISCHER. Have you factored that in? Are you looking to factor that in already for the 2019 budget?

Secretary KLOTZ. Yes, absolutely. Again——

Senator FISCHER. Is that why you're not asking for it now?

Secretary KLOTZ. Well, again, we're asking——

Senator FISCHER. I just want to know if you're asking for what you need, or if you are being overly conservative.

Secretary KLOTZ. We're asking for what we need in fiscal year 2018, and what we need beyond will be factored in as we build the fiscal year 2019 budget, informed by the deliberations and the results that take place in the nuclear posture review.

Senator FISCHER. Okay. Thank you, sir.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

Administrator Klotz, Naval Service Warfare Center in Indiana works with Sandia and others on ensuring the quality and reliability of radiation-hardened microelectronics in our strategic systems. With the progressive off-shoring of U.S. manufacturing capabilities, it's an issue of growing importance for both strategic and conventional military systems.

The microelectronics facility at Sandia is due for replacement over the next 10 years. What actions are being taken to start this process, and what options are you looking at to make sure we take care of everything?

Secretary KLOTZ. Thank you. I think you've laid the problem statement out very well, Senator. We have a specialized need within the nuclear security enterprise for a particular type of microelectronics. These have to be what we call radiation hardened, and there are different types of radiation hardened. The radiation hardening you might need for a space system is different than the radiation hardening you need for a nuclear weapons system given the types of threats that it might encounter from what we call the stockpile-to-target sequence.

You're right, there has been a lot of off-shoring, not only off-shoring of microelectronic production but also foreign ownership of that. So when we're dealing with microelectronics for nuclear weapons systems, they have to be absolutely trusted.

We have relied upon the silicon fabrication facility at Sandia for a number of years to provide a lot of our capability in this area. As you indicated, there are two things that are going on. One is what the rest of industry is doing in terms of the size of the equipment that they use, in terms of production. We've gone from 6-inch wafers—that's what we make now. The rest of industry is already at 12-inch silicon wafers. So we're in the process now of doing a revitalization of the Sandia silicon fabrication facility to allow us to work with 8-inch wafers, which will hold us over until we go to the next level. Then we believe that in 2025 we're going to need to be in the process of recapitalizing the capability to do radiation-hardened microelectronics for ourselves.

There is currently an analysis of alternatives which is getting very, very close to being finished. I believe the initial results are already in the building. Now, let me just say there's a lot of talk about whole-of-government approaches and partnering. Frank Klotz's own personal opinion is we are a niche market or a niche customer as far as this particular market is concerned, and our needs are relatively small and may not necessarily be the needs for the commercial or other government agencies. So we're going to have to approach this with making sure that our priority of having the types of microelectronics that we need for our purposes are met with whatever alternative we come up with.

Senator DONNELLY. Well, as a niche market, who do you get to service that market? Do you ensure that it's secure in the United States? How do you ensure the security of it, and are we best off serving the niche market ourselves?

Secretary KLOTZ. Well, I'm not going to pre-judge the outcome of the analysis of alternatives. I will tell you personally I agree with the statement that you just made. This will have to be, in our view, one that is manufactured in the United States where we can be very, very clear where these materials have come from.

Now, without getting into too many details, there are ways in which you can buy things from the front end and make sure on the back end that you have done the type of engineering that's necessary to enhance your confidence in the material itself. There are other approaches that we're working on in our laboratories and our production facilities to be able to assess, for want of a better word, the trustworthiness of a particular part. I think we would have to discuss that in a different setting to get into the details of that.

This is a great, great concern of ours, and I suspect as well for the entire Department of Defense and the rest of the national security agencies in this country, where the sources of not only microelectronics but other key components that we use in the course of conducting our business are made and manufactured, given the amount of material that in the commercial world comes from overseas or from companies that overseas entities have a major equity share in.

Senator DONNELLY. Thank you.

Ms. Cange, I want to hear from you on the collapse of the tunnel at Hanford that stored contaminated equipment. The tunnel was first constructed in 1956. Referencing wooden beams used on two sides of the tunnel, the most recent structural integrity study conducted in 1991 recommended that, and I quote, "If a decision for final disposition is not made by the year 2001, the structural integrity again should be reviewed in light of any available information, including further tests on wood preservation that may have been completed at that time."

First, did the Department conduct any further structural integrity reviews after 2001? Will you be conducting an analysis of the structural integrity of the tunnel at any point in the near future?

Ms. CANGE. To answer the first part of your question, the Department has not done any structural integrity tests since 2001 of the Purex tunnel. However, we have recently received an administrative order from the State of Washington in response to the collapse, and one of the requirements is that we do perform a structural integrity study and submit it to the state. That study is due by July 1st of this year, and so we are undergoing that study, as well as really focusing on what measures we're going to take to ensure protection looking into the future and coming up with a longer-term and permanent solution to the tunnel and the materials in the tunnel.

Senator DONNELLY. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator.

Senator Sullivan?

Senator SULLIVAN. Thank you, Madam Chair.

Senator FISCHER. I would remind the Senator that we have a vote. So when you're finished, we're going to adjourn until after the second vote is completed. Thank you.

Senator SULLIVAN. I wanted to ask about the Iran nuclear deal and to what degree you were involved in not only the negotiation but the compliance report. So, under the parameters of that agreement, Iran is restricted to 130 metric tons of heavy water. However, in 2016 the IAEA [International Atomic Energy Agency] reported that Iran had, in fact, surpassed that threshold twice.

Madam Chair, I ask unanimous consent for the record that this is an article entitled, "U.N. Agency IAEA Reports Iran Has Again Violated Terms of the Nuclear Deal."

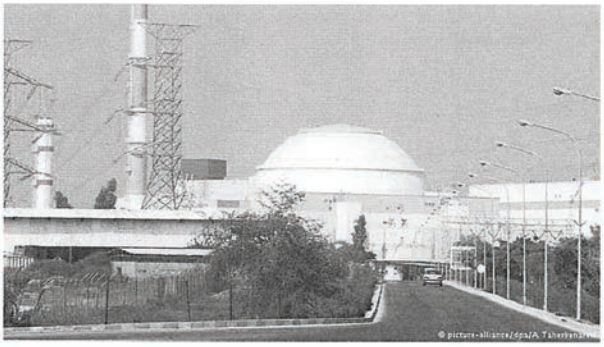
Senator FISCHER. Without objection.

[The information referred to follows:]

NEWS

UN agency IAEA reports Iran has again violated terms of nuclear deal

Iran has violated the terms of its nuclear deal, according to the UN's nuclear monitoring agency. While Iran is resolving the issue it comes as Donald Trump who threatened to undo the deal, won the White House.



For the second time, Iran has surpassed the 130 metric tonne threshold for heavy water, used to cool reactors that can produce substantial amounts of plutonium, according to the UN's International Atomic Energy Agency (IAEA).

In a report issued on Wednesday, the agency monitoring the deal between Iran and six world powers noted that Iran had served notice it would resolve the issue by exporting 5 metric tonnes, substantially over the 100 kilogram (220 pound) excess amount. The shipment is believed to be leaving the country within the next few days.

Just days before, the IAEA had raised the issue with authorities in Tehran: "On 2 November 2016, the director general expressed concerns related to Iran's stock of heavy water to the vice president of Iran and president of the Atomic Energy Organization of Iran, ... Ali Akbar Salehi," the IAEA said in a confidential report seen by Reuters.

In February, a month after the deal went into effect, the IAEA had noted for the first time that Iran had exceeded its allotted limit of heavy water. That time, Iran exceeded the limit by a greater amount, with 130.9 tonnes. Some of the excess was exported to the United States under an arrangement which was criticized by lawmakers in the US congress who saw it as a measure facilitating Iranian violations of the accord.

Sensitive timing

The timing of the report is sensitive, given president-elect Donald Trump's statements on the nuclear deal during the US election campaign.

Trump called the agreement "the worst deal ever negotiated" and said he would "police that contract so tough they (the Iranians) don't have a chance."

In a speech to the pro-Israel lobby group AIPAC in March, Trump declared that his "Number-One priority" would be to "dismantle the disastrous deal with Iran."

The deal was also opposed by Republicans in Congress. They will control both the House of Representatives and the Senate in the Trump administration starting in January 2017.

Iranian President Hassan Rouhani

However, Iran's president has said Trump will not be able to undo the world powers' nuclear deal. President Hassan Rouhani told his cabinet on Wednesday that the 2015 accord "cannot be overturned by one government's decision." The agreement was signed with the United States, Russia, China, Britain, France and Germany.

On Wednesday, the IAEA said Iran has continued living up to its side of the nuclear bargain.

The Islamic Republic's "policies of engagement with the world and the breaking of nuclear sanctions have put Iran's relations with other countries on an irreversible path of growth," Rouhani said.

jm/kl (AP, Reuters)

DW RECOMMENDS

Iran begins work on Russia-supported nuclear plant
Iran has started constructing a second nuclear plant with Russian help in the city of Bushehr. The move comes more than a year after Tehran struck a deal with six world powers that stops Iran from making a nuclear bomb. (10.09.2016)

Iran deploys anti-aircraft missiles to nuclear facility
The Tehran government has placed Russian-supplied anti-aircraft missiles at the Fordo nuclear facility. The uranium enrichment plant was due to be scaled down under last year's deal with world powers. (29.08.2016)

Date 09.11.2016

Related Subjects International Atomic Energy Agency (IAEA), Iran, Donald Trump

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Senator SULLIVAN. So, were you familiar with that violation that the IAEA had cited in 2016, Mr. Klotz?

Secretary KLOTZ. Yes, sir.

Senator SULLIVAN. Do you agree with that assessment, that that was a violation, from the IAEA?

Secretary KLOTZ. I agree with the IAEA's assessment.

Senator SULLIVAN. So were you asked, when Secretary Tillerson recently sent a letter to Congress certifying that Iran was in compliance with the agreement, with the Iran nuclear agreement—how do you square those two issues? Obviously, they were in violation

last year. Were you asked to comment on the Tillerson letter to the Congress?

Secretary KLOTZ. Let me answer it this way, Senator. The State Department clearly has the lead on all actions associated with the Joint Comprehensive Plan of Action or the Iran deal. The role of the Department of Energy and the National Nuclear Security Administration is to be able to draw upon the scientific and technical know-how and knowledge that's resident within our national laboratories, all 17 DOE national laboratories.

Senator SULLIVAN. Like heavy water issues.

Secretary KLOTZ. Yes, sir.

Senator SULLIVAN. I'm sure the members of your organization are much more expert on that than State Department diplomats.

Secretary KLOTZ. Yes. There's another area where we are involved, and I think it's worth pointing out, and that is the support which NNSA in particular in our laboratories, again, and our production facilities provide to the International Atomic Energy Agency, whose headquarters is in Vienna. We help them develop a lot of the technology which they use to assess not only what's going on in Iran but with all other partners to the Nuclear Non-Proliferation Treaty who are subject to safeguards, inspections, and compliance by the IAEA. We help them write their technical manuals on safety, on security, on peaceful use of nuclear weapons. We also, quite frankly, provide a lot of the talent either by sending people over there for short periods of time or actually detailing people to the International Atomic Energy Agency.

Senator SULLIVAN. Let me ask—I hate to interrupt, but let me ask just a basic question. Given your expertise, given that you agreed with the IAEA just a few months ago that Iran was actually in violation of the agreement, how do we get to the point that just a few months later we're now saying that Iran is in compliance with the agreement? Do you have a sense of that? Did they ship the heavy water out? Did they try to cure this violation? I mean, it's very confusing to those of us who try to follow this agreement and think it has a lot of flaws.

Secretary KLOTZ. Well, in the specific case of the heavy water, again, treading on the State Department's area of responsibility——

Senator SULLIVAN. Again, you're much more of an expert on heavy water than they are.

Secretary KLOTZ. In the area of heavy water, what they did is they shipped out—to get to the actual day on which the agreement was formally recognized as being implemented, they shipped out heavy water, and as they approached the limit that you mentioned——

Senator SULLIVAN. One-hundred and thirty metric tons.

General KLOTZ.—they also shipped that out. I would have to get back to what we know——

Senator SULLIVAN. How about you get back to us on that?

Secretary KLOTZ. Yes.

Senator SULLIVAN. Because it sounds like, you know, a couple of months ago you and the IAEA were in agreement that there was a violation, and somehow we get to the point last—I don't know, Secretary Tillerson sent this letter three weeks ago—that they're

no longer in it. It's confusing to a lot of us. Would you, for the record, like to——

Secretary KLOTZ. Sure.

Senator SULLIVAN. Maybe in conjunction with the State Department?

Secretary KLOTZ. I'd be happy to undertake that. Yes, Senator.

Senator SULLIVAN. Let me ask another question, a very different question, and I think again, Mr. Under Secretary, I think you're the point person on this. You know, the counter-WMD [Weapons of Mass Distruction] mission, which is a really important one, doesn't get a lot of discussion. The lead for that recently moved from STRATCOM [Strategic Command] to SOCOM [Special Operations Command], and we had the SOCOM commander testify here recently. You talk about the whole-of-government approach. Again, I think having your expertise and your officials who know a lot about the technical aspects of this is very important.

Are you plugged into that mission at all? If so, how?

Secretary KLOTZ. Absolutely. We worked very, very closely before, when it was under U.S. Strategic Command, and now that it's under SOCOM, we have a full-time liaison officer—civilian serving in Tampa. I had a chance to meet with the deputy commander of SOCOM not long ago. We participate in a number of training exercises. We participate in a number of tabletop command-post exercises, and we train—without going into too many details, we train a lot of their people, if they ever got themselves into a situation where they were confronting a radiological or a nuclear incident, how to carry out their duties.

Senator SULLIVAN. Great. That's very reassuring to hear that you're involved.

The final question. Admiral Caldwell, your responsibilities are over something that's incredibly important, a very strong record, by the way, over decades, in terms of the nuclear Navy. How do you maintain that excellence? How do you maintain the discipline to continue to have that strong record, and what keeps you up at night when you're thinking about your mission?

Admiral CALDWELL. Thanks for the question, sir. We do have a tremendous record. I think that the support of this subcommittee and the funding, the stable funding that we've received is essential to our ability to do that. We hire tremendous folks to work in my organization, and the technical base that is supported by our funding—that's our scientists, technologists, and engineers—is essential to my ability to oversee and ensure the safe, effective operation of nuclear propulsion plants.

Part of our success, a strong part of our success is the culture that Admiral Rickover instilled in the program that we still talk about today, this culture of excellence, the self-critical nature, the stinging into the details, the ownership. These are just some of the tenets that make us successful.

What keeps me up at night is continuing that record of excellence. Right now I'm laser-focused on executing the three major programs that are funded by this subcommittee. That's a lot of work to keep that going. I also am laser-focused on ensuring that the operating fleet is still operated to the high standards to meet

what the Navy needs and also preserve this great record of performance.

Senator SULLIVAN. Great. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator Sullivan.

The committee will stand in recess until we are able to reconvene after the next vote. Thank you.

[Recess.]

Senator FISCHER. Thank you all for your patience. The committee hearing will reconvene at this point. Thank you.

I would ask, next in line is Senator Heinrich.

Senator HEINRICH. Thank you, Chairwoman Fischer. I want to actually thank the Chair and the Ranking Member for bringing up with General Klotz the incredible importance of investing in the plutonium capability and the trusted microelectronics at the Mesa facility, and I would just add to that the importance, not only from a physical investment point of view but the incredible importance of the intellectual capacity that we have at those two facilities.

General Klotz, you mentioned the potential for talk of the whole-of-government approach, and I would just, with my 2 cents, proceed cautiously, because first and foremost we need to make sure we get this right for NNSA's requirements and needs, and those can be very different from other U.S. agencies.

Ms. Cange, I wanted to ask you, I was really pleased to be at the WIPP facility in January when waste disposal operations were restarted. Going forward, what are some of the key milestones and the timeline for restoration for full operation at the WIPP facility?

Ms. CANGE. Thank you. We, too, were very excited with the resumption of activities and operations at WIPP. As you may know, we started shipping waste from the generator sites to WIPP for disposal beginning in April of this year, and when we first started we were limited to two shipments per week. We have shipped waste from Idaho, from Savannah River, and also from Waste Control Specialist facility in Texas, and we are now up to three shipments per week.

We will be adding shipments from the Oak Ridge site, and also the Los Alamos site, later this year. So there are plans underway to increase the number of generator sites sending the waste, and we do plan to get up to four shipments per week by the end of 2017.

Of course, one of our challenges with being able to resume full operations or the level of operations prior to the shutdown is the ventilation system. As I'm sure you know, we have an important capital asset project underway for the installation of a new ventilation system and an exhaust shaft. We are at the 90 percent design review stage for those new facilities, and our current plan is to complete construction and have the facilities operational in the 2021 timeframe. It's at that point that we will be able to resume full operations and go back to what we were, which was approximately 17 shipments per week.

Senator HEINRICH. Great. So, Ms. Cange, in addition to the operating funds for WIPP and, as you mentioned, the investments and the construction of the new exhaust shaft and the ventilation system, one of my concerns is that WIPP is reporting a backlog of

about $25 million in fiscal year 2018 for really critical upgrades for key fire safety systems, for instrumentation, for infrastructure.

Your budget request of $323 million for fiscal year 2018 is certainly below what I think WIPP needs at this point, and I just want you to know that I'll be working to increase the funding for WIPP when we mark up the fiscal year 2018 NDAA.

General Klotz, I have a question for you that relates to recruiting, and we've talked a fair amount about some of the impediments that we have in recruiting at our NNSA labs. Both Sandia and Los Alamos labs are actively recruiting new employees to replace a growing rate of staff retirements, and one of the barriers to hiring these employees that I hear about is the long timeframe that it takes to obtain security clearances for new hires. Some of these backlogs, the backlogs for clearances at each lab, is up to 1,000 new hires and time delays of sometimes over a year.

Do you have any suggestions on what we can do to reduce that backlog at this point?

Secretary KLOTZ. Thank you, Senator. I, too, share your frustration on that, and it is an enormous impediment in terms of hiring people, or once you hire them actually putting them to work for the tasks that you've hired them to do. I'm sad to report that it's not getting any faster in terms of the normal processing of security clearances. At least that's been our experience.

Now, there are a number of things we are doing. We are trying to lean very far forward in the granting of interim clearances for those people who have in their background check, the background check doesn't indicate anything that would ultimately be untoward as far as the award, the granting of a security clearance.

The other thing I've seen going on at both our national laboratories and our production plants, which I commend them on, is going ahead and bringing people on and then starting the process of doing work that is unclassified. For instance, I was at Kansas City plant not long ago where they had sort of a basic course on how you do soldering and putting together the various types of components which they produce there at Kansas City, but doing it in an unclassified setting, so that when their clearances come through they're able to move over. As you well know, Senator, at our laboratories, including Sandia and Los Alamos, one of the things that we do is we bring in a lot of postdocs and interns, other people that we want to work there, put them to work on unclassified projects, a lot of them funded by research and development funds, and then as they get their clearances they can move over to jobs that require those clearances.

Senator HEINRICH. Would you agree that LDRD [Laboratory Directed Research and Development] is an absolutely critical component to be able to recruit the quality of applicants that we need, especially given some of the older infrastructure, the competition with Silicon Valley and other issues, and the remoteness of some of these sites, to the ability to get the best-of-the-best into these national labs?

Secretary KLOTZ. Absolutely, and I appreciate your personal support in stressing the importance of LDRD over these past few years. It's an extraordinarily important way in which to recruit the best and brightest out of our graduate school programs to the lab-

oratories and to give them some challenging science work to do, work that they can publish because it's unclassified for the most part, and then allow them to build up their credibility among their peers.

It also, by the way, has resulted in some fairly important scientific and engineering outcomes which do have some direct correlation to the work that we do either in the nuclear weapons enterprise or for the other customers that the labs have, whether it's other government agencies or whether it's technology which can be transferred to the commercial sector.

Senator HEINRICH. Madam Chair, I apologize for going over my time.

Senator FISCHER. Thank you, Senator.

Senator Peters?

Senator PETERS. Thank you, Madam Chair.

To our witnesses here today, I appreciate your testimony a great deal. Thank you for taking the time to be here.

It's my belief that the continued improvement of nuclear detection technology is an often overlooked component of the international non-proliferation regime. The United States and our allies, particularly at the International Atomic Energy Agency, of course used radiation detectors, seismographs and many other technologies to ensure that countries are abiding by their commitments under treaties, such as the Nonproliferation Treaty, and are not secretly building a nuclear weapon.

The Iran nuclear deal depends in part on the application of this technology, such as devices that can measure and transmit in real time the enrichment level of uranium and centrifuges or detectors that can identify nuclear isotopes in particles about one-tenth of the width of a hair, which is amazing. I believe that it's critical to develop next-generation non-proliferation technology to sustain international norms.

This is especially critical during the years afforded by the Iran nuclear deal so that when some of its components expire, the world standard for non-proliferation can be raised, hopefully during these next few years.

The NNSA's defense nuclear non-proliferation research and development program supports research programs to develop this next generation of nuclear non-proliferation technology, and a prime example that I'm very proud of is research conducted by the Consortium for Verification Technology, which is based at the University of Michigan, which includes universities and national laboratories from across the Nation.

So, General, in your view, how important is new nuclear detection technology for future non-proliferation efforts?

Secretary KLOTZ. Thank you, Senator, for that strong endorsement of a very, very important line of work that we do within the National Nuclear Security Administration. Dave Huizenga is here, who is the Acting Deputy Administrator for Defense Nuclear Nonproliferation. I'm sure he was glad to hear that as well.

We work on a number of different fronts to improve the detection capability for both the U.S. customers, as well as our international partners, and it's not just in the NNSA labs. It's also in the aca-

demic institutions, as you so rightly point out, as well as the other Department of Energy labs.

So some of the things we're doing is we're looking at developing fast-growing large crystals that are an important part of detectors, pushing the limits of chemistry in the process of doing that. We're also looking to make detection equipment less expensive and less bulky and cumbersome so that inspectors, whether they're U.S. inspectors or IAEA inspectors, will be able to carry more with them to detect various radiation sources.

Senator PETERS. Well, the Iran nuclear deal is providing—well, it's now less than 15 years when many of the requirements disappear. Where do you see this technology going in the next 15 years? What can we expect as far as advancements that can help us in hopefully continuing to contain any kind of nuclear program there, and how will you contribute to this effort, or how will the organization contribute to the effort?

Secretary KLOTZ. Well, we'll continue to push the edge of the envelope as far as detection capability is concerned. You already mentioned one of the major contributions that the National Nuclear Security enterprise and our lab enterprise was able to produce. We actually refer to it as the online enrichment monitor, the OLEM, which can fit around a pipe without cutting into the pipe and measure the enrichment of the uranium gas that's actually flowing through it. That was a huge development and one that we passed on to the International Atomic Energy Agency for their use.

As more Nations express interest in and pursue commercial nuclear power as a means of meeting their energy goals for the future, the demands placed upon the IAEA to be able to carry out its safeguard and safety mission is only going to increase. I think we'll have a lot of work ahead of us to make sure they have not only the diagnostic tools they need to do this but also the protocols that they follow in forcing compliance with the safeguard agreements under the Nuclear Nonproliferation Treaty.

Senator PETERS. In addition to my service here on the Armed Services Committee, I'm also a member of the Homeland Security Committee, and the Department of Homeland Security also is engaged in this research effort, and it also has a number of programs related to it.

General Klotz, as well as Mr. Trimble, could you perhaps talk a little bit about whether or not there is overlap between what you're doing, what the Department of Homeland Security is doing, and what sort of coordination is going on between these entities?

Secretary KLOTZ. We are working very, very closely together, both at sort of the working group level, the action officer level, particularly on areas related to nuclear detection and also responding to a nuclear or radiological event that might take place here in the United States.

In terms of duplication, I personally don't think there is much. We made some decisions in the past where we decided, for instance, various capabilities would reside within the Department of Homeland Security and various things would continue to reside in the Department of Energy. Again, we also work together through a thing known as the Mission Executive Council, which meets at my level as well as my counterparts in the Department of Home-

land Security and other government agencies to work out those kinds of lines of business that we have.

Senator PETERS. Director Trimble?

Mr. TRIMBLE. In regards to the research and development programs, that's not an area that we've dived into in terms of the overall duplication.

Senator PETERS. Great. Thank you for your testimony. I appreciate it.

Senator FISCHER. Thank you.

Senator Warren?

Senator WARREN. Thank you, Madam Chair.

Thank you all for being here today.

Despite our differences, which are many, Russia and the United States both want to prevent the spread of nuclear weapons, and we've had some real success on that front in the last 30 years. After the fall of the Soviet Union we worked together to remove nuclear material from Central and Eastern Europe, and over time we have down-blended over 500 tons of highly enriched uranium from Soviet-era nuclear weapons.

That's changed. In 2014, the Russians terminated much of our bilateral nuclear security cooperation. In 2016, they refused to attend the 2016 Nuclear Security Summit, and later in 2016 they pulled out of a 16-year-old agreement to destroy 34 tons of plutonium, which is enough to make about 17,000 nuclear weapons.

General Klotz, in light of shrinking United States-Russia cooperation, what is NNSA's strategy to ensure that Russia's large nuclear complex and stockpiles of nuclear material remains secure? What's the plan now?

Secretary KLOTZ. I think, Senator, you've laid it out very well, the history of this, with the Nunn-Lugar and the other work that DOE did separate from Nunn-Lugar. I happen to have been serving in Moscow from 1999 to 2001 in our embassy there and saw firsthand the work that was being done by both Department of Defense and Department of Energy in helping secure Russian nuclear facilities, doing work to get control of all the materials there, and that was very, very productive work. We established a lot of good working relationships at the technical level, scientist to scientist, engineer to engineer. It did come to a halt, and it came to a halt I think for two reasons.

One, the Russians felt that, given the turnaround in their economic situation, that they no longer needed to be in a donor-recipient relationship as far as aid to help secure their nuclear facilities. Then, of course, there were all the differences in our relationship that have developed as a result of the invasion of Crimea, the annexation of Crimea, and so on.

So, the way in which we continue to cooperate is we are not doing work inside Russia other than cleaning up a couple of contracts that had already been in place. We are prohibited by statute from entering into any new contracts with Russia, assuming they even want to at this stage, which they don't. So we're left with working with the Russians, and we continue to work with the Russians on what we would refer to as third-party efforts; for instance, repatriating Russian-origin fuel from other countries back to Rus-

sia. We have just recently done that with Russian-origin highly enriched uranium in Kazakhstan.

So we're looking for opportunities to do that. I would suggest if there ever is a change in our relationship at the higher political level, it strikes us that this is a natural place for cooperation to develop, resume and develop, because what we are talking about, again, as I said earlier, scientist to scientist, technician to technician.

Senator WARREN. Right.

Secretary KLOTZ. Largely divorced from the larger, higher policy issues.

Senator WARREN. That's very worrisome, where we stand right now.

Let me ask you another part of this. Since the 1990s, the U.S. has spent billions of dollars to build nuclear infrastructure on Russian territory for things like training centers and sensors and nuclear safeguards and other technology. Now that Russia is not cooperating in these areas that we talked about, how is NNSA verifying that Russia is maintaining this infrastructure, and how do we make sure that this investment is not wasted?

Secretary KLOTZ. That's a very good question, and I probably will need to get back to you on the details. When we were actively engaged in cooperation with Russia on nuclear security within Russian borders, our people traveled there quite extensively to do the same sort of oversight we do here in the United States with our laboratories and production facilities to make sure that the contracts and the assistance we were providing was being used for the purpose for which it was intended.

Senator WARREN. You know, the way I keep looking at this, we have a lot of problems, obviously, with Russia, and we need a very strong response to their interference in Ukraine, what they're doing in Syria, the attack on democratic electoral systems here in the United States and around the globe, but we don't have to agree on everything to agree that nuclear proliferation is bad and that we want to work together to stop it. So I appreciate your efforts on this.

If I can, in my remaining time, I have one other question I want to ask you about. Among your other responsibilities, General Klotz, you also oversee some of the world's most powerful supercomputers, including the three national ones here—Los Alamos, Sandia, and Lawrence Livermore. We use these powerful supercomputers for models and simulations, obviously for our nuclear weapons stockpile, but we also use them for physics research and climate change and biological systems and weather forecasting. They're important for lots of things, and this has always been an area of national excellence for the United States.

In recent years, however, China seems to be out-pacing us. Currently, China has the number-one and number-two most powerful supercomputers in the world.

So, General Klotz, in the little time I have left, can I just ask you to say something about is the United States losing ground in supercomputing; and if so, should we be concerned about that?

Secretary KLOTZ. Senator, I think we should be concerned about it, but not just to have the fastest, best computer, although I'm a very competitive person, so that appeals to me.

Senator WARREN. Good.

Secretary KLOTZ. We need to develop the computing capabilities in order to meet the requirements we have to do the modeling simulation that you talked about to maintain a stockpile that is safe, secure, and effective.

If you'll indulge me for just a minute—I realize time is running out. Indulge me just for a minute. The advances in high-performance computing in the United States were pioneered by the Atomic Energy Commission and the Manhattan Project, working with academic institutions and industry across the United States, because we've always had this demand for the ability to process large amounts of data, and we continue to advance the frontiers. We just put in a new computer at Los Alamos, Trinity. Next year we'll put in a new computing platform at Lawrence Livermore National Laboratory called Sierra, and we are jointly embarked upon what we refer to as an exo-scale computing initiative with DOE's Office of Science to get us to the level of exo-scale, which is 10-to-the-18th, a quintillion flops of capability to do the 3D [3-Dimensional] high-fidelity simulations we need to do in the future.

So in NNSA alone we have, basically, last year in the omnibus we had $95 million going to develop the process, and we're asking for $158 million in the next. So that shows you, I think, the commitment in the Department of Energy, the commitment of NNSA to advance our capabilities in this particular area. This money is not going to buy the platform. Industry will buy the platform. We have to make sure that whatever industry develops, we will be able to run the kind of codes that we need to on the architecture they have, whether it's for the weapons program or the other lines of research, weather and biological, that you rightly pointed to.

Senator WARREN. Thank you very much. I'm glad to hear that this is very much a priority for you. I'm a strong supporter of investments in this area. They will pay dividends for the future, not only for our nuclear enterprise but for all of our scientific research. So please count on me as an ally on this.

Secretary KLOTZ. Thank you, Senator.

Senator WARREN. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator.

If I could follow up a little bit with Senator Warren's questioning about Russia, you made the comment, General, that we are not actively engaged within Russia's borders right now. Can you tell me if Russia is cooperating with your efforts to secure Russian material in foreign countries?

Secretary KLOTZ. Yes.

Senator FISCHER. Russia's argument at the time, in 2014, was that it didn't need the U.S. assistance to secure the material. You referenced that their economy had turned around and they felt that way. What's your assessment of that claim?

Secretary KLOTZ. I do think—my personal assessment of that claim is they have, in fact, improved significantly in terms of security of both military and domestic radiation and sources of nuclear

material. We continue to worry, and I would add that there are still things that could be done. We would probably have to discuss the specifics of that elsewhere and the basis of our worry. All countries, including the United States, need to continue to focus on safety and security of these special materials. It's a journey, it's not a destination, and there is a lot of work that needs to be done everywhere, including inside Russia.

Senator FISCHER. So in a classified setting we need to discuss——

Secretary KLOTZ. Yes, yes.

Senator FISCHER.—since cooperation ceased, where they are on that.

Secretary KLOTZ. Yes, ma'am.

Senator FISCHER. Thank you.

Also, back to my first line of questioning. When we look across the list on NNSA's construction projects, it looks like the plutonium project at Los Alamos is the only one that Congress appropriates at the sub-project level. You referenced that. Do you believe that that's helpful or hurtful?

Secretary KLOTZ. Our druthers, our preference would be that we be appropriated not at the sub-project level, and let me tell you why. For instance, with the uranium processing facility, you appropriated at the level of the uranium processing facility. We have a number of sub-projects under that. What that does is it gives us the flexibility that if we achieve some savings, which we have in the uranium processing facility sub-projects, we can move that money to other areas of the overall project that need that funding at that particular time. Now, within the CMRR [Chemistry and Metallurgy Research Replacement] program, we would essentially, if we found that we had saved some money in some area or we had a higher priority in another area, we would have to come to the four committees to ask for reprogramming. With all the work that those committee staff have to do, it just takes time to get that through, and we may be late or we may be pushing some work to the right that will drive up cost.

I think there's ample opportunity on the part of committee staff and for members to exercise oversight. We send up the project data sheets. We come up and routinely brief staff and members on the work that we're doing there. We put out a strategic stockpile management plan every year, and we have these budgets, including the congressional justifications that go in there that tell you exactly what we're doing, almost in real time.

Senator FISCHER. Thank you, General.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

Admiral Caldwell, I understand the electric drive for the *Ohio* replacement is behind schedule, as we had talked about. Can you explain what happened and what's being done to get us squared away, and the impact it will have on your integration to the *Ohio* replacement submarine?

Admiral CALDWELL. Yes, sir. In February of this year, we discovered that we had a manufacturing error on a pre-production motor. It's a prototypical motor. That prototypical motor is designed to go into a test facility with other pre-production components to prove

out the integration of those components, and then what we learn there will go into the final production motor that will go onto the first ship.

What we discovered was that the prime contractor's vendor did not properly flow down some requirements for the motor, and as a result some portions of the motor were not properly insulated. The impact is that we will have to extend our test program. The subcontractor is going to make this right. They're going to tear down the motor and rebuild it with the proper insulation. They're also procuring a second pre-production motor that will give us two paths to get to our integrated testing.

That all said, we built plenty of margin into the schedule because there's so much riding on getting electric drive correct. Even with this 9-month extension of our integrated testing, we will still meet the required in-yard date for the final production motor.

Additionally, we've taken action to ensure that the design specifications are flowing to the prime and subcontractor and sub-tier vendor appropriately, and there's been an increase in oversight at all levels.

I'd also like to make sure that I point out that the money to support this effort is on the DON [Department of Navy] side of my budget and not the DOE side of the budget.

To reiterate, we are still able to meet our required in-yard date for the final production motor.

Senator DONNELLY. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator Donnelly.

I would like to thank all the members of the panel for being here today. We always appreciate the information that you provide to us.

If any members have any written questions for you, I would ask that you respond in a timely manner.

With that, I will adjourn the subcommittee. We are adjourned.

[Whereupon, at 4:13 p.m., the subcommittee was adjourned.]

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR DEB FISCHER

DEFERRED MAINTENANCE AND EXCESS FACILITIES

1. Senator FISCHER. Secretary Klotz, with an increased emphasis and funding for deferred maintenance and disposition of excess facilities on NNSA sites, by what process will NNSA determine which projects are performed through existing Management & Operations contracts, and which projects will be transferred to the Office of Environmental Management?

Secretary KLOTZ. Deferred maintenance reduction is paid for by the DOE Program (e.g., NNSA) that owns the facility. Record of facility ownership is documented in the DOE Facility Information Management System (FIMS). Similarly, the disposition of non-process contaminated facilities is funded by the DOE Program that owns the facility.

However, the deactivation and decommissioning of process contaminated facilities is the responsibility of DOE's Office of Environmental Management (EM). Therefore, the determination of which excess facilities are addressed by the DOE/EM is based on whether or not the facility is process contaminated. This distinction of responsibilities for the disposition of process-contaminated facilities was reinforced in the reports accompanying fiscal year (FY) 2006 Energy and Water Development appropriations bills, which provided direction that environmental cleanup activities remain with DOE/EM. Additional information on this process can be found in the December 2016 report to Congress on the Plan for Deactivation and Decommissioning

of Nonoperational Defense Nuclear Facilities. NNSA must have agreement and acceptance from EM before any process contaminated buildings can be transferred.

The DOE/EM request includes $225 million for a targeted effort to accelerate deactivation and decommissioning (D&D) of specific high-risk facilities at the Y–12 National Security Complex and the Lawrence Livermore National Laboratory not currently in the EM programs' inventory to achieve substantial risk reduction within four years. This effort supports modernization of the nuclear security enterprise. Below is a list of the NNSA Y–12 and Lawrence Livermore facilities that are part of this effort in rough priority order by site.

Y–12 National Security Complex
- Alpha-4 Building 9201–4 COLEX Process Equipment
- Beta-4 Classified Tool Storage Facility Building 9720–24
- Critical Experiment Facility Building 9213

Lawrence Livermore National Laboratory
- Pool Type Reactor Building 280
- MARS E–Beam Facility Building 175
- Heavy Elements Facility Building 251

QUESTIONS SUBMITTED BY SENATOR JOE DONNELLY

IMPLEMENTATION OF AUGUSTINE MEIS RECOMMENDATIONS

2. Senator DONNELLY. Secretary Klotz, the National Academies of Science and Public Administration are reviewing the recommendations from the various governance studies that have taken place over the last four years to ensure not only are they implemented but they make a difference. Can you explain how you are ensuring these recommendation are not only implemented but revisiting them to make sure they are having the effect they were intended?

Secretary KLOTZ. NNSA is working closely with the joint Implementation Assessment Panel from the National Academies of Sciences (NAS) and National Academy of Public Administration (NAPA) to track the progress and effectiveness of the steps it has taken to follow the recommendations made in the various governance studies. NNSA has adopted the DOE Office of Science model to develop more rigorous and dependable Contractor Assurance Systems (CAS) to improve its governance and oversight of field operations at its laboratories, sites, and plants. As a part of this new approach, NNSA will conduct its first site peer review in July.

As recommended by NAS and NAPA in their 2017 report, *Tracking and Assessing Governance and Management Reform,* NNSA has defined an effective mission-focused operating model as the vision for implementing the changes. NNSA is currently working with its management and operating contractors to develop meaningful metrics to identify, measure, and track the effectiveness of those changes.

REPLACEMENT OF THE SPENT FUEL HANDLING FACILITY AT THE IDAHO NATIONAL LABORATORY

3. Senator DONNELLY. Admiral Caldwell, what is the status of the replacement for the spent fuel handling facility at the Idaho National Laboratory? When do you expect it to operational? How much will it cost?

Admiral CALDWELL. With the funding provided by Congress in fiscal year (FY) 2017, the Spent Fuel Handling Recapitalization Project is finalizing major facility design requirements and the facility's design. Additionally, in fiscal year 2017, Naval Reactors has commenced long lead material procurements for the Project and will begin site preparation activities at the Naval Reactors Facility on the Idaho National Laboratory. The first phase of construction will start as early as the fourth quarter of fiscal year 2018, pending approval of critical decision 3 and the results of the geotechnical engineering investigation of the basalt. This is consistent with the Project's schedule and will deliver the fully executed capability in fiscal year 2025 at a total project cost of $1.65 billion.

WASTE ISOLATION PILOT PLANT

4. Senator DONNELLY. Ms. Cange, the Waste Isolation Pilot Plant is now starting to accept waste from DOE sites. What is the status of replacing the ventilation system from the accident and how much will it cost? When do you expect full operations of the site?

Ms. CANGE. The current ventilation system permits continued and increasing emplacement rates of waste. A new Safety Significant Confinement Ventilation system is necessary to increase emplacement rates and allow simultaneous mining activi-

ties. The new Safety Significant Confinement Ventilation System along with a new exhaust shaft are in the design phase with start of construction expected in fiscal year 2018 and operation expected in the 2021 timeframe, subject to the completion of the National Environmental Policy Act process. The preliminary cost range for the Safety Significant Confinement Ventilation System is estimated to be $189 to $280 million and the new exhaust shaft is estimated to be $81 to $118 million.

Simultaneous mining and waste emplacement activities are expected to occur once the new ventilation system becomes operational in the 2021 timeframe.

PLUTONIUM OPERATIONS AT LOS ALAMOS

5. Senator DONNELLY. Mr. Trimble, you most recently reported on the status of the plutonium operations at Los Alamos National Laboratory. What are your observations of this effort relative to achieving pit manufacturing of 30, 60 and eventually 80 pts per year?

Mr. TRIMBLE. NNSA's Fiscal Year 2017 Stockpile Stewardship and Management Plan (SSMP) stated that the agency will increase its capability to produce new pits over time to support life extension programs: 10 pits per year in 2024, 30 pits per year in 2026, and 50 to 80 pits per year by 2030. According to NNSA, the agency needs plutonium analysis equipment, and the space to house the equipment, to support its planned pit production rates. Providing this plutonium analysis capability is the goal of the ongoing Chemistry and Metallurgy Research Replacement (CMRR) project (construction project number 04–D–125). We reported in August 2016 that the CMRR project, as approved in 2014, may not provide enough analysis capacity to support a 10 pits-per-year pit production rate (GAO–16–585). To increase its plutonium analysis capacity, NNSA approved a restructuring of the CMRR project in November 2015 that added a new subproject to upgrade the Radiological Laboratory Utility Office Building (RLUOB) from a radiological facility to a Hazard Category 3 nuclear facility. We reported that NNSA's contractor found that upgrading the RLUOB, if combined with other successful efforts, would likely support a 30 pits-per-year production rate, and possibly 80 pits per year under a best case scenario. Further, in response to one recommendation in GAO–16–585, NNSA stated that it would perform an analysis to estimate a pit production capacity range that the CMRR project will support, to be completed by September 30, 2017.

Since August 2016, NNSA's estimated completion date for the CMRR project has slipped, raising some questions about the agency's ability to meet the pit production timeframes laid out in the 2017 SSMP. Specifically, NNSA stated in its fiscal year 2018 budget request that the agency has moved back its forecasted end date for the CMRR project by 2 years, from 2024 to 2026. The budget request also stated that the 2026 end date is a preliminary estimate, in part, because the new subproject to upgrade the RLUOB is still in design, and NNSA estimated it will not approve that subproject's schedule baseline at critical decision (CD) 2 until 2022.

According to NNSA, the other key component of meeting the agency's pit production goals is the Plutonium Modular Approach project, for which the agency approved the mission need (CD0) in November 2015. We also found in GAO–16–585 that it is unclear whether this project will help meet plutonium analysis needs—if CMRR cannot provide sufficient capacity to support 50 to 80 pits-per-year—because NNSA did not specify in its mission need documentation whether providing such analysis capacity is a requirement of that project. NNSA officials told us in June 2017 that the project's Analysis of Alternatives was ongoing, with completion later in 2017.

LOW ACTIVITY WASTE REMEDIATION AT HANFORD

6. Senator DONNELLY. Ms. Cange, what are the Department's observations on the findings of the GAO relative to using grouting for the next 60 percent of the low activity waste at Hanford and what actions would the Department have to undertake with the State of Washington to determine if it is feasible to implement?

Ms. CANGE. As you know, in early May 2017, GAO issued the subject report following a 2-year review of Hanford's management of the lower activity portion of its tank waste. The report compared treatment and disposal methods used for other tank wastes at Savannah River Site, Idaho National Laboratory, and West Valley Demonstration Project. GAO made two recommendations in its report. DOE agreed with these recommendations:

- DOE should provide updated information on the effectiveness of alternate treatment and disposal methods, and
- DOE should have an independent entity evaluate alternative treatment and disposal options and life-cycle costs of those options.

The Department is currently responding to these GAO recommendations through studies conducted as required by fiscal year (FY) 2017 National Defense Authorization Act (NDAA), Section 3134. The fiscal year 2017 NDAA requires the Department to enter into an arrangement with a federally-funded research and development center (FFRDC) to conduct analysis of approaches for treating a portion of low activity waste at Hanford that is intended for supplemental treatment, and to specifically consider the use of grouting technologies, among other options. The NDAA also requires the National Academies of Science, Engineering and Medicine to conduct a concurrent review of the analysis conducted by the FFRDC. The required analysis is co-led by Savannah River National Laboratory and Pacific Northwest National Laboratory. A concurrent peer review is also underway by the National Academies of Sciences, Engineering and Medicine.

The Department has in the past performed numerous studies related to alternative treatment technologies for Hanford's low activity tank waste, including studies of grout. These alternative treatment technologies are identified and their potential environmental impacts are analyzed in the *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland Washington* (DOE/EIS–0391). The Department does not have a preferred alternative at this time regarding supplemental treatment for LAW and believes it beneficial to study further the potential cost, safety and environmental performance of wasteforms produced by supplemental treatment technologies. This year the Department funded laboratory-scale research aimed at evaluating the feasibility of grouting low activity waste using actual tank waste as opposed to simulants which had been used in the past. The Department is also supporting laboratory scale research examining how glass loading could be increased to treat additional low activity waste in WTP during its operating lifetime. In addition, analysis of the capabilities of the onsite low level waste disposal facility to retain radionuclides, called a Performance Assessment, will assist the Department in assessing the potential of using these alternative treatment technologies.

7. Senator DONNELLY. Mr. Trimble, you recently released a report on grouting the next 60 percent of the low activity waste at Hanford that is not scheduled to be vitrified. Can you tell the committee how much money this would save? What actions would the Department of Energy have to do with the State of Washington to determine if this recommendation is feasible?

Mr. TRIMBLE. In May 2017, we reported on DOE's efforts to treat the low-activity portion of the tank waste at the Hanford Site. DOE currently plans to treat up to one-half of the low-activity waste (LAW) at Hanford with a process called vitrification, which immobilizes the waste in glass. However, at the Savannah River Site, DOE is grouting the site's LAW; grout is a process that immobilizes waste in a concrete-like mixture. We found that the best available information indicates that DOE's estimated costs to grout LAW at the Savannah River Site are substantially lower than its estimated costs to vitrify LAW at Hanford, and DOE may be able to save tens of billions of dollars by reconsidering its waste treatment approach for a portion of the LAW at Hanford.

DOE should work with the state of Washington to ensure that any action it takes with respect to low-activity waste is carried out consistently with the Tri-Party Agreement and the state's Dangerous Waste Management Permit, including seeking such amendments as the parties may agree are necessary and consistent with law.

HIGH EXPLOSIVES MANUFACTURING

8. Senator DONNELLY. Mr. Trimble, the NNSA has a large effort in remanufacturing high explosives for the life extension programs. What issues do you think at this time are important from an oversight perspective?

Mr. TRIMBLE. NNSA's March 2016 Stockpile Stewardship and Management Plan (Plan) notes that high explosive (HE) production, storage, and research and development and test and evaluation are critical nuclear security enterprise capabilities. These activities are conducted at a number of NNSA sites. HE is an important part of the W88 alt 370 and the W80–4 life extension program (LEP). To support these efforts, NNSA recently constructed a new HE pressing facility at its Pantex Plant in Amarillo, Texas to supply War Reserve HE.

We have not reviewed NNSA's HE operations in detail. However, Senate Report 115–125, accompanying S. 1519, the Senate version of the National Defense Authorization Act for Fiscal Year 2018, includes a provision for us to review NNSA's HE capability. More specifically, the report directs us to:

(1) identify all Department of Energy (DOE) and NNSA HE R&D and production capabilities specific to nuclear weapons, the justification for these sites, and what is known about the costs to maintain them;
(2) examine DOE's projected requirements for HE capabilities to support the stockpile and work for others;
(3) compare these requirements to current capabilities to identify any gaps or duplication in these capabilities; and
(4) assess how NNSA plans for its HE capability and the extent to which it manages this capability as a strategic material.

The report directs us to provide congressional defense committees a briefing within 270 days of the enactment of the bill with a full report to follow. We anticipate starting this work in calendar year 2017.

ROUND 4

9. Senator DONNELLY. Secretary Klotz, the microelectronics facility at Sandia is due for replacement over the next ten years. It produces unique chips for nuclear weapons in radiation environments that are not duplicated anywhere else. What actions are you taking to start this process and what options are you looking at?

Secretary KLOTZ. Currently we are conducting the Trusted Microsystems Capability (TMC) Analysis of Alternatives (AOA), which is scheduled to be completed in fiscal year (FY) 2017. This AOA evaluates the cost and effectiveness of different options for fabricating trusted radiation-hardened microelectronics for NNSA needs. In fiscal year 2018, we will complete the conceptual design, preliminary hazard analysis, and integrated safety management plan as required for the selected alternative. NNSA will ensure sufficient overlap between the Sandia National Laboratories facility closure and implementation of the chosen alternative to guarantee that future production needs are met.

10. Senator DONNELLY. Admiral Caldwell, you are refueling the S8G reactor at the Knolls Atomic Power Laboratory with *Ohio* replacement fuel. What is the status of the refueling operation? How much will it cost and when will it be completed?

Admiral CALDWELL. The S8G Prototype Refueling Overhaul is set to begin execution in fiscal year (FY) 2018. This availability will refuel the reactor core, and complete needed maintenance and modernization of components and systems to support the next, approximately, 20 years of operation. Currently, Naval Reactors (NR) is completing construction of the Radiological Work and Storage Building, which will provide the radiological work and laydown space for the industrial subcontractor, and shipping refueling equipment from the shipyards to the Kesselring Site in upstate New York. The lead maintenance activity for the overhaul, Newport News Shipbuilding, has begun planning the work and identifying approximately 300 tradesmen required for execution. In parallel, NR is manufacturing the Technology Demonstration Core (TDC), which will use the alternate core materials necessary to support the life-of-ship reactor core for the *Columbia*-class submarine. Manufacturing and inserting the TDC core into the S8G Prototype will reduce the manufacturing risk for the *Columbia*-class and provide operational data that will inform the operating parameters for the *Columbia*-class ships. The refueling overhaul will be complete in fiscal year 2020 and the prototype will be available for research and development efforts as well as student training in fiscal year 2021. The total cost of the availability is $1.57 billion.

11. Senator DONNELLY. Ms. Cange, you grout low activity waste at the Savannah River Site. How do you store the grout and where will it be permanently disposed? How does thus differ from Hanford?

Ms. CANGE. The grout is disposed of on-site in above ground concrete storage vaults (Salt Waste Disposal Units).

A March 12, 2016, court order and modification to an existing Consent Decree between DOE and the State of Washington sets a deadline of December 31, 2023 to complete hot commissioning of the Low Activity Waste (LAW) Facility and begin treating the waste. The vitrified low activity waste will be disposed of onsite in the low level waste Integrated Disposal Facility. Because the duration of processing this waste is expected to surpass the design life of the LAW Facility, a decision regarding a supplemental treatment capability is anticipated in the future. DOE has, in the past, looked at various options for the supplemental treatment capability (referred to as Supplemental LAW), including grout, and a study of this subject is currently underway as required by the fiscal year 2017 National Defense Authorization Act.

12. Senator DONNELLY. Mr. Trimble, lithium is an important component of the life extension programs for the warheads. You conducted an analysis of the lithium operations at the NNSA, what are you observations?

Mr. TRIMBLE. NNSA halted certain aspects of its lithium production operation—conducted at its Y–12 site—in May 2013 due to the condition of the site's 72-year old lithium production facility. In response to concerns that usable lithium could run out without additional actions, NNSA developed a strategy that proposed a new lithium production facility by 2025 and identified "bridging" actions needed to meet demand through 2025. In July 2015, we reported on the challenges and limitations in NNSA's lithium production strategy (GAO–15–525). Notably, we reported that:

(1) NNSA may not have a sufficient supply of lithium material for defense program requirements. According to NNSA officials, increases in demand will exhaust the supply of currently qualified lithium—lithium approved for use in weapon systems in refurbishment—by 2018 without additional actions.
(2) The existing lithium production facility and equipment at NNSA's Y–12 National Security Complex in Tennessee are at risk of catastrophic failure. In March 2014, for example, a 300-pound slab of concrete fell from the ceiling into an active work area.
(3) Key elements of NNSA's lithium production strategy are based on the assumption that the Lithium Production Capability facility will be designed and constructed from 2016 to 2023 and ready for use by 2025. However, fiscal constraints could cause delays in the construction of a new lithium production facility.

NNSA identified various actions it could take to mitigate these challenges—including procuring lithium from outside sources , outsourcing certain aspects of the lithium production process, and accelerating the design and construction of the Lithium Production Capability facility—but these actions were in early stages of development.

Since our July 2015 report, the timeframes for the design and construction of the new facility appear to have slipped—making it unlikely that accelerated timeframes could be used to mitigate the challenges identified in 2015. We reported in July 2015 that NNSA's lithium strategy was premised on facility design beginning in 2016 but NNSA's fiscal year 2017 budget request indicated that NNSA would request funds in fiscal year 2019 to start new lithium production facility design activities. In addition, according to NNSA's fiscal year 2017 Stockpile Stewardship and Management Plan (SSMP), new lithium production capability was planned to be in place around 2028; not 2025 as previously planned. NNSA's fiscal year 2018 budget does not request funding for construction of the lithium production facility; however, it identified a total of approximately $161 million in construction funds to be requested over the fiscal year 2019 to 2022 time period, and approximately $552 million in total funding needs for the project in the outyears beyond fiscal year 2022. Until new lithium production capability is in place, according to NNSA's fiscal year 2017 SSMP, the agency will continue with its "bridging" strategy to ensure safe operations in the current lithium production facility and sustain capabilities and material supplies at Y–12.

ADDITIONAL QUESTIONS

13. Senator DONNELLY. Secretary Klotz, what is the status of the cruise missile W80–4 life extension program and are there any issues we should be concerned with?

Secretary KLOTZ. The W80–4 life extension program is on-track and progressing as expected. The program is currently in the Feasibility Study and Design Options Phase (6.2) of nuclear weapons refurbishment activities (defined as the Phase 6.X acquisition process), formally authorized by the Nuclear Weapons Council in July 2015. We anticipate Phase 6.2 will conclude in fiscal year 2017, with immediate entry into the Design Definition and Cost Study Phase (6.2A) as planned in fiscal year 2018.

A focus area for NNSA is to ensure alignment with the Air Force's development activities and schedules for the Long Range Standoff (LRSO) cruise missile as they execute their respective Design Development efforts. After the Air Force awards the LRSO contracts for Technical Maturation and Risk Reduction (TMRR), scheduled for later this year, NNSA will begin a joint process to align program schedules through a series of Technical Interchange Meetings with the Air Force Program Office and the two missile contractors. The goal of this effort will be to align NNSA design development efforts in Development Engineering, Phase 6.3, with the contractor missile design during the Department of Defense's TMRR phase such that the program

has gained sufficient confidence through joint testing to commence Production Engineering, Phase 6.4.

14. Senator DONNELLY. Secretary Klotz, what is the status of the W88 life extension program and the replacement of the high explosives?

Secretary KLOTZ. The W88 Alteration (Alt) 370 remains on schedule, with a first production unit (FPU) scheduled for December 2019. The program accelerated activities for the Conventional High Explosive (CHE) refresh to align with the original Alt 370 scope. Full alignment was achieved when the program received authorization to transition into Phase 6.4 Production Engineering in February 2017. This authorization came after the completion of the Development-Engineering Phase, the combined System Baseline Design Review (March 2016), the Department of Defense design review (September 2016), and the System Pre-production Engineering Gate (January 2017). The CHE refresh scope will not delay the W88 Alt 370 FPU.

THE NUCLEAR SECURITY ENTERPRISE

15. Senator DONNELLY. Secretary Klotz, NNSA's SSMPs from fiscal year 2014 through fiscal year 2017 have shown sharp increases beyond the agency's out-year budget estimates (its Future-Year National Security Program budget or FYNSP). For example, the W80–4 program's low-range cost estimate for fiscal year 2017 exceeds the budget estimate by about $26.9 million. Budget estimates for some modernization programs for fiscal years 2018 through 2021 are more than $5 billion below the funding levels NNSA has identified needing. If funding needs are not met, will NNSA have to defer some modernization work? How would this affect the agency's overall modernization schedule? What actions is NNSA taking to mitigate the impact of schedule delays?

Secretary KLOTZ. NNSA's Future Years Nuclear Security Program annual programming process allocates available resources based on funding priorities while maintaining a careful balance between near-term and long-term needs of the stockpile and the nuclear security enterprise supporting the stockpile. Should resource constraints prevent appropriation of the Administration's full funding request, NNSA will analyze the short and long-term needs and assume risk in programs where possible, using techniques and strategies to mitigate these risks. While this could involve deferring planned modernization activities or shifts to planned program schedules, these decisions are carefully coordinated to ensure national security needs continue to be met. One example of actions to mitigate impacts include the conduct of detailed Analysis of Alternatives in order to explore the feasibility of alternative investment strategies that can meet enterprise needs while conserving valuable resources.

16. Senator DONNELLY. Secretary Klotz, over the last several years, NNSA has appointed strategic material managers to oversee the capabilities to continue to produce such materials. Many studies of the nuclear security enterprise have found that overlapping and poorly defined functions and authorities have fostered inefficient procedures and cultures within DOE and NNSA. What impact have the strategic material managers NNSA appointed to oversee sustainment of the capabilities needed for these materials had on the sustainment efforts? NNSA had planned to appoint a lithium manager; has one been appointed?

Secretary KLOTZ. NNSA established strategic material managers in 2014 to integrate, oversee, plan, and execute material strategies. Each strategic material manager is the executive accountable to the NNSA Administrator for ensuring the mission-related capabilities and capacities are available to customers. The strategic material managers provide written biweekly reports and quarterly briefings directly to the Administrator and other senior leaders. NNSA clearly defines the roles and responsibilities for these managers and establishes their authorities in the new NNSA Business Operating Procedure (BOP) 06.07, issued in January 2017. The strategic material managers have been successful in developing and managing their overall mission strategy, mission requirements, and technology development activities.

Strategic material managers have been designated for uranium, plutonium, tritium, and domestic uranium enrichment capabilities. NNSA is determining how best to establish additional strategic material managers for lithium and possibly other materials.

17. Senator DONNELLY. Secretary Klotz, in 2014, NNSA established the Office of Cost Estimating and Program Evaluation (CEPE) to provide the Administrator with independent, data driven analysis. CEPE can best support NNSA program and project management when cost data is freely shared throughout the nuclear security

enterprise and with the related offices within the Defense Department. However, there have been instances of program offices refusing to share data with properly cleared counterparts in other offices. What is your position on data sharing among program offices? How can NNSA move toward greater data sharing to help program offices better analyze information and negotiate contracts?

Secretary KLOTZ. NNSA uses and shares data across the nuclear security enterprise (NSE) as a critical element to continue to improve program management and performance for Planning, Programming, the Budgeting and Evaluation process, Independent Cost Estimates, Analysis of Alternatives, and various analyses to support mission needs.

NNSA, as part of a disciplined and integrated processes, continues to institutionalize program and project management. Data driven program and project management analyses and decisions are critical to NNSA's efforts to further improve quality management and performance.

NNSA is also continuing efforts to work with the management and operating (M&O) contractors to improve and integrate cost and indirect structures with program and project management tools. NNSA has made progress on data visibility and consistency in the development of a common financial reporting system to improve and integrate financial management and cost visibility across the NSE. These collaborative efforts between NNSA and its M&Os build on the foundation of data sharing for defined requirements in accomplishing mission and mission support work.

There are two examples of NNSA's Office of Cost Estimating and Program Evaluation's use of programmatic data for analysis include the following Reports to Congress.

1. Report to Congress, "Cost Estimating and Program Evaluation Activities and Major Atomic Energy Defense Acquisition Program Status," (May 1, 2015).
2. Report to Congress, "Cost Estimating and Program Evaluation Fiscal Year 2015," (November 14, 2016).

NUCLEAR NONPROLIFERATION

18. Senator DONNELLY. Secretary Klotz, in September 2015, GAO reported that GTRI (now part of M3) spent $5 million in reactor conversion activities worldwide, out of the $559.5 million in funding from fiscal years 2009 through 2013 to support international conversion activities. Progress on such activities has stalled since 2013. How has M3 used funding appropriated for conversion activities since 2005?

Secretary KLOTZ. M3 has used all the $559.5 million appropriated for conversion activities between fiscal years (FY) 2009 and 2013 to convert domestic and international research reactors and isotope production processes from Highly Enriched Uranium (HEU) to Low Enriched Uranium (LEU) fuel and targets, and to accelerate the establishment of a domestic, commercial supply of the critical medical radioisotope molybdenum-99. The $5 million figure cited by the Government Accountability Office (GAO) refers only to funds that were appropriated and costed between fiscal year 2009 and 2013 on foreign research reactors that were converted. Due to the long timeframes (5 to 10 years) in reactor conversion projects, most of the funds to support the 25 conversions during fiscal year 2009 and 2013 were appropriated prior to 2009 and, therefore, not reported to the GAO. Since fiscal year 2013, NNSA's Office of Material Management and Minimization has converted or verified the shutdown of 15 HEU research reactors and isotope production facilities, with much of the funding coming from appropriations received during the fiscal year 2009 to fiscal year 2013 that were also not reflected in the GAO report.

19. Senator DONNELLY. Secretary Klotz, what is NNSA's strategy for engaging "hard case" countries with vulnerable or poorly secured nuclear materials, and what is the evidence or what are the prospects that these efforts are having or may result in significant nuclear security improvements in those countries?

Secretary KLOTZ. Where possible, NNSA engages bilaterally with countries with vulnerable nuclear materials to discuss best practices and provide technical guidance on securing these materials. For countries where bilateral interactions are not possible, NNSA works through multilateral organizations, such as the International Atomic Energy Agency (IAEA) to encourage these "hard cases" to meet their obligations to secure their material in accordance with IAEA recommendations which have increased standards in recent years. Over the past two decades working with its international partners, NNSA has eliminated more than 6,200 kilograms of nuclear material, including all highly enriched uranium from 31 countries and Taiwan; provided upgrades to 221 buildings with weapons-usable nuclear material in the

Former Soviet Union; equipped more than 600 sites around the world with radiation detection systems to combat nuclear and radiological terrorism, and; recapitalized the IAEA's ability to safeguard nuclear material around the world. Because of the importance of securing nuclear materials, NNSA will remain flexible and adjust its approach to ensure that nuclear materials that could be used for a nuclear weapon do not fall into the hands of terrorists.

WHISTLEBLOWER PROTECTIONS

20. Senator DONNELLY. Secretary Klotz and Ms. Cange, in 2016, GAO reported on DOE's insufficient whistleblower protections. DOE has taken limited or no action to hold contactors accountable for creating a chilled work environment. DOE officials provided GAO with examples where (1) little or nothing was done in response to intimidation of contractor employees who report safety and other concerns; (2) a subcontractor was terminated after reporting safety concerns; and (3) a contractor employee was terminated allegedly because she cooperated with GAO. What actions has DOE taken to improve whistleblower protections and hold contractors accountable for intimidating and retaliating against whistleblowers?

Secretary KLOTZ. The Department is strongly committed to a workplace where all workers are free to raise concerns without fear of retaliation. In particular, contractors are statutorily and contractually bound not to retaliate against employees for protected whistleblower conduct. DOE takes concerns of retaliation very seriously. To further the commitment to whistleblower protection, the Department recently issued a final rule, which became effective in March 2017, clarifying that the Department may issue civil penalties against certain contractors and subcontractors for instances of whistleblower retaliation that concern nuclear safety. Among other things, the Department requires its contractors to inform contractor employees of their right to file a formal complaint pursuant to applicable regulations. The Department has also:

- Increased the awareness of a healthy safety culture, to include training more than 2,000 Federal and contractor managers in leadership for a safety conscious work environment.
- Promptly investigates claims of retaliation as well as the allegations that may have prompted the complaint of retaliation;
- Communicates/reinforces expectations of establishing and maintaining a positive safety culture and Safety Conscious Work Environment (SCWE), and the need to foster an environment of trust, a questioning attitude and receptiveness to raising issues.
- Periodically evaluates using standard industry survey instruments the organizational climate at its sites.

A number of venues and processes have been established for contractor and subcontractor employees to raise concerns or escalate issues if they perceive a lack of concern or action from their own management or by DOE responsible officials. Furthermore, several mechanisms exist for contractor and subcontractor employees to pursue claims that they have been retaliated against for raising concerns before, depending on the circumstances, the Department, the Department's Office of the Inspector General, or the Department of Labor.

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ENVIRONMENTAL MANAGEMENT

21. Senator DONNELLY. Ms. Cange, in the 2016 NDAA, Congress required DOE to obtain an owner's agent to assist in overseeing the WTP contractor. What is the status of DOE's acquisition of an owner's agent for oversight of the WTP contractor?

Ms. CANGE. On September 30, 2015, the Department selected Parsons Government Services, Inc. as the Owner's Representative.

22. Senator DONNELLY. Ms. Cange, how does EM plan to handle the remaining waste drums not yet disposed of at WIPP that share contents similar to the one that caused the contamination at WIPP?

Ms. CANGE. These drums are located at the Los Alamos National Laboratory and the Waste Control Specialists' facility in Texas. At Los Alamos, treatment recently began on the drums containing a mix of nitrate salts and organic stabilizer like the one that ruptured at WIPP. Treatment on the drums is expected to be finished in fiscal year 2017. For the drums stored at the Waste Control Specialists, LLC, facility, we are conducting a feasibility study to identify the best options to treat and eventually dispose of those drums at WIPP.

23. Senator DONNELLY. Ms. Cange, the investigations that followed the February 2014 fire and radiological release accidents at WIPP reported 122 judgements of need to DOE to address deficiencies in safety practices that contributed to the accidents. To what extent have DOE and its WIPP management and operations contractor completed corrective actions to address the judgments and evaluated the effectiveness of those actions?

Ms. CANGE. The Accident Investigation Board Reports on the fire and radiological release events at WIPP in 2014 resulted in 122 judgments of needs that prompted corrective actions by DOE, the M&O contractor, Nuclear Waste Partnership, LLC (NWP), and Los Alamos National Laboratory (LANL). The Carlsbad Field Office and the NWP were assigned 241 corrective actions. Of these, 234 actions were completed prior to re-starting waste emplacement activities at WIPP. The remaining 7 actions were to be completed after re-start. These actions included additional training and qualifications for staff, and the performance of effectiveness reviews. The estimated completion date for these remaining corrective actions is the end of 2017.

24. Senator DONNELLY. Ms. Cange, DOE is exploring construction of an above-ground storage facility for temporary onsite storage of transuranic waste at WIPP. To what extent has DOE discussed the above-ground storage concept with the New Mexico environmental regulators responsible for permitting the storage facility? To what extent has DOE identified the cost and schedule estimates for completing the storage facility?

Ms. CANGE. In September 2016, a permit modification request was submitted to the New Mexico Environment Department for an above-ground storage facility for temporary on-site storage of transuranic waste at WIPP. The facility will be a concrete storage pad with capacity to store 408 containers (136 shipments) of contact-handled transuranic waste. DOE and the WIPP Management and Operations Contractor, Nuclear Waste Partnership, LLC held two public meetings in Santa Fe and Carlsbad on October 25 and October 27, 2016, respectively to discuss this temporary storage facility. Construction of the storage pad is estimated to cost less than $10 million and to be operational in the 2019 timeframe, subject to the completion of the National Environmental Policy Act process.

25. Senator DONNELLY. Ms. Cange, has DOE sought to reclaim damages from the contractors for their actions that contributed to the accidents at WIPP? What is DOE's estimate of the costs of these accidents? What is the total fee that has been withheld and fines imposed on the contractors as a result of the accidents?

Ms. CANGE. The Department estimates the cost for recovery and resumption of waste emplacement operations at WIPP at approximately $246 million. This in-

cluded activities such as facility program enhancements, revision of the Documented Safety Analysis, underground habitability and operations, facility upgrades, etc. This does not include activities funded in the base program, e.g., environmental compliance, Resource Conservation and Recovery Act activities, administrative programs, or the capital asset project line items (e.g., cost of new ventilation systems). The estimated WIPP recovery cost of $246 million does not cover the cost for WIPP-related provisions in the Settlement Agreement reached with the New Mexico Environment Department in 2016.

The Department held the WIPP and Los Alamos National Laboratory (LANL) contractors accountable for actions that contributed to the fire and the radiological events at WIPP by issuing violations against each contractor for deficiencies in their programs and by withholding fee. For fiscal year 2014, of a possible award fee of $63.4 million, Los Alamos National Security, LLC (LANS) received $6.2 million. The Department also initiated steps to separate LANL's programmatic mission from the legacy cleanup effort by establishing a dedicated EM LANL field office, and by initiating a procurement for a new LANL cleanup contract.

EM also held Nuclear Waste Partnership (NWP) accountable for performance under its contract for WIPP by significantly reducing the total fee available to the company in accordance with the contract. NWP collected less than approximately 7 percent of the available $8.2 million in fee in fiscal year 2014. In addition to significantly reducing available fee, DOE issued an interim Contractor Performance Assessment Report to ensure that the lapses in contractor performance related to the fire and release incidents were made part of the contractor's permanent performance record in the federal past performance rating system. EM also required NWP to provide and implement a corrective action plan to improve oversight, bolster the safety culture, upgrade equipment and adjust operations to address factors that contributed to the accidents. In addition, EM redefined NWP's performance objectives to include safety as a primary performance goal. With the significant changes to the Design Safety Analysis and Technical Safety Requirements combined with additional ventilation and nuclear safety requirements for the underground, DOE determined that the fiscal year 15 and 16 work scope for WIPP was to recover and reopen the facility. Fee bearing work was identified within this work scope and developed on an annual basis in accordance with the contract.

QUESTIONS SUBMITTED BY SENATOR MARTIN HEINRICH

MICROLAB PILOT PROGRAM

26. Senator HEINRICH. Secretary Klotz, section 3120 of the NDAA for fiscal year 2016 established a microlab pilot program to help stimulate open collaboration for universities and businesses with the NNSA labs and the commercialization of lab-developed technologies. Sandia National Laboratories has proposed a new Center for Collaboration and Commercialization (C3), with Phase I to be located in downtown Albuquerque. Is NNSA supportive of the C3 and what is the current status and timeline for the project?

Secretary KLOTZ. NNSA is supportive of this effort. Phase I of the Preliminary Real Estate Plan (PREP) for the Center for Collaboration and Commercialization Node in downtown Albuquerque was approved by DOE/NNSA, through the Sandia Field Office, on June 5, 2017. A Request for Quotations will be submitted with the intention of moving into a leased space (of approximately 1000 square feet) by the end of the year. The plan for Phase II, pending approval and Congressional funding, is to lease approximately 20,000 square feet near the Sandia Science and Technology Park sometime between fiscal year 2018 and 2019.

LDRD

27. Senator HEINRICH. Secretary Klotz, section 3119 of the fiscal year 2017 NDAA established a pilot program to eliminate overhead costs on spending for Laboratory Directed Research and Development at the NNSA labs. Will the pilot program be implemented at the start of fiscal year 2018 as required?

Secretary KLOTZ. Yes, the NNSA laboratories will implement the pilot program to remove general and administrative (G&A) costs from the Laboratory Directed Research and Development (LDRD) program at the start of fiscal year 2018. NNSA continues to meet with NNSA laboratory Chief Financial Officers to discuss pilot program implementation prior to issuing annual forward pricing guidance in June 2017, along with working with respective LDRD leads through the NNSA LDRD Working Group.

ALBUQUERQUE COMPLEX ON KIRTLAND AIR FORCE BASE

28. Senator HEINRICH. Secretary Klotz, I appreciate your joining me last year to tour the 1950s-era office buildings housing about 1,100 federal employees at the Albuquerque Complex on Kirtland Air Force Base. The building doesn't meet basic safety requirements and will be replaced with a new facility on Eubank Boulevard designed to LEED Gold standard. I'm pleased to see the budget request for the project is $98 million for fiscal year 2018. What is the current status of the project and when do you expect construction to begin?

Secretary KLOTZ. NNSA is committed to transforming the Cold War nuclear weapons complex into a 21st Century enterprise. One key component of NNSA's enterprise is the Albuquerque Complex, which has become too old, too costly, and is in an entirely unsatisfactory state for NNSA's highly skilled workforce.

The Albuquerque Complex Project will replace the existing complex with a single new building that meets sustainable building requirements. The modern facility will house the workforce who support a broad range of NNSA programmatic capabilities necessary for both current and future NNSA missions. This new building will provide modern, safe, and reliable infrastructure that improves the safety and working environment for approximately 1,200 site employees. The project will be executed via a firm-fixed-price contract with USACE. It will be structured as two subprojects: one for construction of the new facility and one for D&D of the old Albuquerque Complex.

In August 2015, NNSA completed an Analysis of Alternatives (AOA), and the Alternative Selection and Cost range (CD–1) was approved in February 2016. The DOE Office of Project Management and Oversight Assessment performed an Independent Cost Estimate (ICE) in September fiscal year 2016 resulting in a total project cost (TPC) range of $199 million to $247 million. The project reached 60 percent design maturity in May 2017 and is currently on track to request combined approval of the Performance Baseline and Start of Construction (CD–2/3) in the second quarter of fiscal year (FY) 2018. Construction is projected to be completed in the first quarter of fiscal year 2022.

QUESTIONS SUBMITTED BY SENATOR ELIZABETH WARREN

SUSTAINING NUCLEAR SECURITY INFRASTRUCTURE WITHIN RUSSIA

29. Senator WARREN. Secretary Klotz, since the 1990s, the United States has spent billions of dollars to build nuclear infrastructure on Russian territory—for things like training centers, sensors, nuclear safeguards, and other technology. Now that Russia is unwilling to cooperate on many bilateral proliferation activities, how is NNSA verifying that Russia is maintaining this infrastructure? Does NNSA have a strategy to ensure that this investment is not wasted?

Secretary KLOTZ. NNSA's security upgrades and assistance to secure Russia's nuclear infrastructure were provided under the Cooperative Threat Reduction umbrella agreement which allowed assurance visits for three years after the completion of the upgrades. The assurance period for a great deal of the assistance expired even before the Russian decision to discontinue the joint work. However, NNSA's cooperation with Russia always included a strong sustainability component that focused on ensuring that the Russians had the technical capability and financial resources to maintain the upgraded nuclear security infrastructure. Despite this effort, NNSA remains concerned over the long-term sustainability of NNSA's investments. Now that NNSA no longer has direct access to Russian facilities to verify the status of NNSA-provided upgrades, NNSA is attempting to remain engaged with Russian counterparts wherever possible through mutually-beneficial and cost-shared technical exchanges at bilateral and multilateral fora.

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2018 AND THE FUTURE YEARS DEFENSE PROGRAM

WEDNESDAY, JUNE 7, 2017

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

NUCLEAR ACQUISITION PROGRAMS AND THE NUCLEAR DOCTRINE

The subcommittee met, pursuant to notice, at 2:32 p.m. in Room SR–222, Russell Senate Office Building, Senator Deb Fischer (chairman of the subcommittee) presiding.

Present: Senators Fischer, Cotton, Sullivan, Sasse, Donnelly, Heinrich, Warren, and Peters.

OPENING STATEMENT OF SENATOR DEB FISCHER

Senator FISCHER. Good afternoon. The hearing will come to order. The subcommittee meets today to receive testimony on nuclear doctrine, strategy, and acquisition programs of the Department of Defense. This will be our final hearing in this subcommittee before the full committee conducts its markup of the fiscal year 2018 National Defense Authorization Act later this month.

I would like to express my thanks to Senator Donnelly and to the staff for the hard work that they have done. This has been a bipartisan effort based on the firm commitment both sides share in sustaining and modernizing our nuclear forces. On this committee, there is a strong bipartisan support for nuclear modernization based on the obvious wisdom of not letting our systems age to the point of unilateral disarmament.

As President Obama stated in his 2009 speech in Prague: Make no mistake, as long as nuclear weapons exist, the United States will maintain a safe, secure, and effective arsenal to deter any adversary, and guarantee that defense to our allies.

I believe most of the members of this body agree with that statement, and understand that maintaining a capability, particularly one that has been allowed to age the way our nuclear deterrent has, does require modernization. In that regard, I am pleased to see the Department's request for the upcoming fiscal year make the necessary investments in our nuclear forces.

We look forward to hearing from our witnesses in greater detail about the fiscal year 2018 budget request and where this budget does accept risk. The Department has also recently begun a new Nuclear Posture Review, which I hope will take into account all the changes in the security environment and plan for the future of our nuclear forces accordingly.

Dr. Soofer, I am sure that we will hear from you on this subject.

I thank the witnesses in advance for their testimony today and for their work on this important mission. There is nothing more important than maintaining the security, reliability, and effectiveness of our nuclear weapons.

With that, I recognize the ranking member, Senator Donnelly, for any opening remarks that he would like to make.

Senator Donnelly?

STATEMENT OF SENATOR JOE DONNELLY

Senator DONNELLY. Thank you, Madam Chair. I want to thank our witnesses for testifying today. It is good to see so many familiar faces.

I want to start by pushing back on a quote from a former Obama administration official that ran yesterday in a New York Times article. This individual called into question a bipartisan consensus we built on nuclear modernization over the past several years. From where I sit, that cannot be more wrong. We built a great partnership on this committee, and I am confident it will continue going forward.

Mr. Soofer, you have years of experience serving this committee in working with members on both sides of the aisle on these critical issues. I hope you agree with my assessment on the strength of our working relationship. Welcome back. I look forward to your testimony, and I am glad the Department is putting your talents to good use on the upcoming Nuclear Posture Review.

General Rand and Admiral Benedict, thank you for your service and leadership. You are both well-known to this subcommittee, and we hold your capabilities and professionalism in the highest regard.

Mr. MacStravic, I am looking forward to a productive relationship with your office. I want to be sure that, as you reorganize the DOD [Department of Defense] Acquisition Organization, that the Assistant Secretary for Nuclear, Chemical, and Biological Defense Programs is kept intact. This office is critical to maintaining effective oversight of our weapons programs, especially as we confront the nuclear modernization bow wave.

As we face an increasingly complex global nuclear environment, I think Secretary Carter was absolutely right when he called our nuclear deterrent the bedrock of our national defense. I look forward to today's hearing as an opportunity to hear about the successes and the challenges faced by the Department and how we can best support your efforts, strengthen our deterrent, and protect our beloved country.

Thank you again.

Senator FISCHER. Thank you, Senator Donnelly.

With that, I would open the hearing for the opening statements from our panel, and would remind each of you that your full statements will be included in the record.

General Rand, if you would begin, please?

STATEMENT OF GENERAL ROBIN RAND, USAF, COMMANDER, AIR FORCE GLOBAL STRIKE COMMAND

General RAND. Chairman Fischer, Ranking Member Donnelly, and distinguished members of the subcommittee, thank you very much for allowing me to appear before you today to represent the men and women of Air Force Global Strike Command. I testified several times before this subcommittee, and I am looking forward to speaking about the progress and the changes that have taken place in Air Force Global Strike since our last meeting.

My priorities for the command remain the same. They are mission, airmen, and families. We exist to serve the Nation by providing strategic deterrence and global strike in a world that is continually changing and challenging the status quo.

Modernization of the nuclear force is mandatory. Fiscal constraints, while posing planning challenges, do not alter the national security landscape or the intent of competitors and adversaries, nor do they diminish the enduring value of long-range strategic forces to our Nation. If we are to maintain or, in some instances, regain the strategic lead we have on our potential adversaries, we cannot delay this modernization.

Madam Chairman and subcommittee members, I want to thank you for your dedication to our great Nation and the opportunity to appear before you to highlight the need for modernization in efforts across Air Force Global Strike Command. I look forward to your questions.

[The prepared statement of General Rand follows:]

PREPARED STATEMENT BY GENERAL ROBIN RAND

INTRODUCTION

Chairman Fischer, Ranking Member Donnelly, and distinguished Members of the Committee, thank you for allowing me to come before the committee and represent the over 34,000 Air Force Global Strike Command (AFGSC) Total Force Airmen. It is an honor to be here today, and I look forward to updating you on what the command has accomplished and where we are going.

AIR FORCE GLOBAL STRIKE COMMAND MISSION

As you know, the command focuses on the stewardship and operation of two legs of our nation's nuclear Triad and the Air Force's nuclear command, control, and communications capabilities while simultaneously accomplishing the conventional global strike mission. As long as nuclear weapons exist, the United States must deter attacks and maintain strategic stability, and at AFGSC, we're especially focused on today's evolving world and tomorrow's emerging threats.

The command's top priority is to ensure our nuclear arsenal is safe, secure, effective and lethal. This priority underlies every nuclear-related activity in AFGSC, and we must never fail in the special trust and confidence the American people have bestowed on our nuclear warriors. To that end, our nation's leaders must continue to support and advocate for the sustainment and modernization of these weapon systems.

Our bomber and Intercontinental Ballistic Missile (ICBM) forces, and our nuclear command, control, and communications systems defend our national interests, assure our allies and partners, and deter potential adversaries; should deterrence fail, we stand ready to defeat our adversaries through the persistent application of combat power.

AIR FORCE GLOBAL STRIKE COMMAND FORCES

Intercontinental Ballistic Missile Forces

Twentieth Air Force (20 AF), one of two Numbered Air Forces in AFGSC, is responsible for the Minuteman III (MMIII) ICBM, UH–1N helicopter forces, and the Kirtland Underground Munitions Maintenance and Storage Complex at Kirtland Air Force Base, New Mexico. The 450 dispersed and hardened launch facilities (LFs), controlled and maintained by AFGSC Airmen every single day, preserve strategic stability by providing the Nation a credible, responsive deterrent, which presents adversaries a nearly insurmountable obstacle of numbers should they consider a disarming attack on the United States.

Minuteman III

We continue to sustain and modernize the Minuteman III ICBM and its command, control, and communications systems and support equipment. We continue moving forward on the $62 million FYDP Transporter Erector (TE) Replacement Program (TERP) and the $76 million FYDP Payload Transporter (PT) Replacement (PTR) to modernize our existing fleet of large missile maintenance vehicles. We currently expect TERP and PTR to begin production in fiscal year 2018.

We are also equipping ICBM launch control centers (LCC) with modernized communications systems that will improve and replace aging and obsolete systems. The LCC Block Upgrade, expected to begin full deployment in 2019, is a $70 million modification effort that replaces multiple LCC components to include a modern data storage replacement for floppy disks and new Voice Control Panels to provide higher fidelity voice communications. We continue to push forward on improving Remote Visual Assessment at our remote launch facilities, a significant security upgrade, to improve situational awareness and security. We expect this $40 million program to begin deployment in fiscal year 2019.

We conducted four reliable MMIII flight tests in Fiscal Year 2016 that, along with two Simulated Electronic Launch tests in the operational environment, demonstrated the operational credibility of the nuclear deterrent force and the AF's commitment to sustaining that capability. Four operational flight tests are currently funded in fiscal year 2017 ($39 million), satisfying both United States Strategic Command (USSTRATCOM) and National Nuclear Security Administration (NNSA) requirements. We have already conducted three tests; the last is scheduled for August.

We are nearing completion of our efforts to remove 50 ICBM boosters from their LFs as part of our effort to meet New START Treaty limits. The LFs are spread across all three ICBM wings and will remain fully operational and capable of receiving boosters, if needed. The final booster is expected to be removed in early June 2017.

Ground Based Strategic Deterrent

The Minuteman weapon system was fielded nearly 60 years ago, yet has remained a cornerstone deterrence platform. ICBMs are the sole weapon system capable of rapid global response and impose a time-proven and unpalatable cost to attack by peer, near-peer and aspiring nuclear nations. The current system, the Minuteman III, suffers from age out, asset depletion, and numerous performance shortfalls. Simply put, it will not meet critical mission performance requirements or force commitments by 2030.

To meet these requirements, we're successfully moving forward on developing the Ground Based Strategic Deterrent (GBSD). OSD/AT&L approved the GBSD Acquisition Strategy in July of last year, and Milestone A was achieved on 23 August 2016. The GBSD is fully funded, $5.6 billion fiscal year 2018–22, and in source selection with an expected on-time contract award (up to two offerors) in 4QFY17, initiating a three year acquisition risk reduction activity. When complete, a second cost-reducing, competitive source selection will identify a single provider and initiate material development efforts beginning in the 2020 timeframe.

Additionally, we remain engaged with our Navy partners and have identified promising areas for intelligent commonality between GBSD systems and future Navy weapons, and we are collaborating with the NNSA to develop a W–78 warhead life extension program for our aging nuclear assets, starting in 2020. The replacement warhead, Interoperable Warhead 1 (IW1) is planned to deploy with GBSD; however, due to system age-out, attrition, and commitment requirements, the first priority is to modernize the necessary facilities, replace the missile, and sustain and maintain command and control (C2) systems.

UH–1N

AFGSC is the lead command for the Air Force's fleet of 62 UH–1N helicopters. The majority of these aircraft support two critical national missions. The UH–1N provides vital support in the security of our ICBM fields and critical Continuity of Operations and transport missions in the National Capitol Region. Additionally, they support Air Force survival training with rescue operations. Further, they participate in the Defense Support of Civil Authorities program and are frequently called upon to conduct search and rescue activities for missing or injured civilians.

UH–1N Follow On

In order to continue supporting these critical national missions and fully comply with DOD and USSTRATCOM requirements, the Air Force has committed $2 billion fiscal year 2018–2022 to replacing the UH–1N fleet, as the platform falls short of missile field operational needs—notably speed, range, endurance, payload, and survivability. The Air Force is pursuing a full-and-open competition to procure 84 replacement helicopters. We plan to release the final request for proposal in summer 2017, with contract award in fiscal year 2018.

Bomber Forces

Eighth Air Force is responsible for the B–52H Stratofortress (B–52) bomber, the B–2A Spirit (B–2) bomber, and the B–1B Lancer (B–1) bomber. Bombers provide decision makers the ability to demonstrate resolve through generation, dispersal, or deployment.

Global Assurance and Deterrence

To assure our allies and partners, and to increase regional stability, AFGSC provides bomber forces arrayed across the globe to provide flexible, responsive options to combatant commanders. The deployments in support of the United States Central Command area of responsibility (AOR) and the Continuous Bomber Presence (CBP) in the United States Pacific Command (USPACOM) AOR send a strong signal to our allies of our commitment to their regions. Additionally, AFGSC provides bomber forces to support United States Southern Command's (USSOUTHCOM) Joint-Interagency Task Force-South (JIATF–S), United States European Command (USEUCOM), and United States Africa Command (USAFRICOM) through the Joint Staff's Global Force Management (GFM) process and Bomber Assurance and Deterrence (BAAD)-ordered deployments and missions. These opportunities enhance our support to our allies and display our resolve to our adversaries. The core of AFGSC assurance and deterrence is our unwavering commitment to United States Strategic Command (USSTRATCOM) and our nuclear deterrence operations (NDO). AFGSC must balance global force posturing with our NDO mission, while not jeopardizing readiness and fleet health. Arraying bomber forces globally, to increase strategic flexibility and respond to a changing global security environment, while doing no harm to our NDO mission, will further enhance our assurance to allies and partners and posture our forces in such a manner where our adversaries will take notice.

B–1

The B–1 is a highly versatile, multi-mission weapon system that carries the largest payload of both guided and unguided weapons in the Air Force inventory. It can rapidly deliver large quantities of precision and non-precision weapons in support of combatant commanders around the globe.

The B–1 will be in demand for at least two more decades and avionics and recent weapon upgrades are critical for it to remain a viable combatant commander tool. The Integrated Battle Station (IBS)/Software Block-16 (SB–16) upgrade, the largest ever B–1 modification ($210 million fiscal year 2018–2022), includes an upgraded Central Integrated Test System (CITS), Fully Integrated Data Link (FIDL), Vertical Situation Display Upgrade (VSDU), and a simulator upgrade. This marks a fantastic capability upgrade, and the associated cockpit upgrades provide the crew with a much more flexible, integrated cockpit.

B–52

The B–52 may be the most universally recognized symbol of American airpower . . . its contributions to our national security through the Cold War, Vietnam, Desert Storm, Allied Force, Iraqi Freedom, Enduring Freedom and now Operation Inherent Resolve are well documented. The B–52 is able to deliver the widest variety of nuclear and conventional weapons.

I anticipate the B–52 will remain a key element of our bomber force until at least 2050; it is paramount that we continue to invest resources into this aircraft now to keep it viable in both conventional and nuclear mission areas for the next 30 to 40 years. Our B–52s are still using 1960s radar technology with the last major

radar upgrade done in the early 1980s. Currently, the mean time between failure rates on the B–52 radar is 46 flight hours. The current radar on the B–52 will be even less effective in the future threat environment, and without an improved radar system, there will be increased degradation in mission effectiveness. In order to remedy this, the $500 million FYDP B–52 Radar Modernization Program is approaching the conclusion of its Capability Development Document phase and will enter the program pre-Milestone B.

Today we have 21 of the B–52s converted to the CONECT configuration. This modification moves the B–52 into the digital age for the first time. This on-board LAN will allow the crew to share a common battlespace picture. This modification is installed on every aircraft going through their regular program depot maintenance cycle.

The 1760 Internal Weapons Bay Upgrade increases B–52 smart weapons capacity by 67 percent. This capability reached its IOC milestone in May 2016 and will be adding Joint Air-to-Surface Standoff Missile (JASSM) and Joint Air-to-Surface Standoff Missile-Extended Range (JASSM–ER) capability in late summer 2017.

Communications remain the cornerstone of our strike capability. The ability to launch bombers and retask / retarget them while enroute to the fight is a powerful force multiplier. We will be adding a critical communications node to enhance the operational picture with Link-16 integrating the aircraft into the warfighter's efforts. Currently, the B–52 is the only Combat Air Forces platform without Link-16. Additionally, we are exploring options to re-engine the B–52 to make it more fuel efficient and cost effective.

Finally, I want to point out that we have converted 29 operational and 12 stored B–52 aircraft to conventional-only configurations. These conversions were undertaken as a part of the U.S.'s New START obligations.

B–2

For nearly 25 years, our B–2s have provided the Nation with an assured penetrating bomber capability. The B–2's ability to penetrate enemy defenses, holding any target at risk with a variety of nuclear and conventional weapons, has provided deterrence against our enemies and stability for our allies.

We are starting the most aggressive modernization period in the history of the B–2. This effort is addressing a Nuclear Command and Control need, bringing Very Low Frequency (VLF) and Extremely High Frequency (EHF) Satellite communications capability to the aircraft. Additionally, with the proliferation of Anti-Access Area Denial (A2/AD) threats, we are ensuring the B–2's ability to penetrate enemy defenses is maintained with the Defensive Management System Modernization program. Finally, the B–2 is upgrading to carry the B61–12 nuclear gravity weapon. This upgrade is critical to ensuring the bomber leg of the nuclear triad remains a visible deterrent to those who wish us harm.

Small fleet dynamics continue to challenge our sustainment efforts primarily due to vanishing vendors and diminishing sources of supply. We are striving to maintain the proper balance of fleet modernization and sustainment while maintaining combat readiness. Lessons learned from the difficulty sustaining and modernizing the B–2's small-fleet should be considered when determining the purchase size of future acquisitions such as the B–21.

B–21

Technology gaps between the U.S. and potential adversaries are closing. The B–21 will support the nuclear Triad by providing an advanced and flexible deterrent capability, with the ability to penetrate modern and future air defenses. Further, the B–21 will provide flexibility across a wide range of joint military operations using long range, large and mixed payloads, and survivability. The B–21 program will extend American air dominance against next generation capabilities and advanced air defense environments.

The B–21 is designed to have an open architecture, which enables it to integrate new technology and respond to future threats. The B–21 is fully funded in the fiscal year 2018 budget submission, and an initial capability is projected for the mid-2020s.

As the B–21 is developed and goes into production, the Air Force is also preparing for future basing and the required facilities on those bases. While the B–21 will bring new construction and facility renovation costs, we believe the current bomber bases are best suited to absorb the new mission. Simply put, the current bomber bases were custom built to support and sustain bomber operations. In many cases, they already have the environmental framework and airspace agreements in place. Additionally, the current bomber bases also have the infrastructure and missions for maintenance, munitions storage, security, simulators, base operating support net-

work, off-base community support, and many of the other areas required for bomber operations. New bases may require more construction, infrastructure, and investment dollars. While preparing for future B–21 basing, our primary focus will be providing safe, secure, and effective bomber operations in a cost-efficient manner.

Air Launched Cruise Missile

The AGM–86B Air Launched Cruise Missile (ALCM) is an air-to-ground, winged, subsonic nuclear missile delivered by the B–52. Fielded in the 1980s, the ALCM is over 30 years old, well beyond its life expectancy and is involved in its third life extension program. While the ALCM remains effective today, we must replace it due to its aging subsystems, the shrinking stockpile of operational missiles (553), and advances in enemy defenses. We plan to invest $162 million in fiscal year 2018–2022 to continue life-extension programs including critical telemetry, encryption, and flight termination components until our Long-Range Stand-Off (LRSO) weapon reaches operational capability in 2030.

Conventional Air Launched Cruise Missile

The AGM–86C, Conventional Air Launched Cruise Missile (CALCM) is a conventional variant to the ALCM. It's only employment platform is the B–52 and unlike the ALCM, CALCM has not received any life-extension programs to maintain reliability or viability against enemy defenses. Current NDAA language has prevented the service from removing this aging and obsolete weapon system from operational use pending the development, testing, and initial fielding of a LRSO conventional variant. The conventional long range stand-off capability currently resides in JASSM–ER and is a more survivable weapon system with low observable characteristics. JASSM–ER is capable of employment from the B–52, B–1, or B–2. It is prudent that when our bomber force continues to make advancements in capability, that we divest ourselves of CALCM and focus our training and maintenance resources towards the use of more capable weapons which hold our adversaries at risk.

Long Range Stand-Off Missile

The AF dedicated $2.7 billion fiscal year 2018–2022 for the LRSO to replace the aging ALCM. The ALCM has significant capability gaps that will only worsen through the next decade. The LRSO will be a reliable, long-ranging, and survivable weapon system and an absolutely essential element of the nuclear triad. It will be flexible, and will be compatible with B–52 and B–21 platforms. The LRSO missile will ensure the bomber force continues to hold high value targets at risk in an evolving threat environment, including targets deep within an area denied environment. I cannot overemphasize this point: B–21 and B–52 without LRSO greatly reduces our ability to hold adversaries at risk, increases risk to our aircraft and aircrew, and negatively impacts our ability to execute the mission. Additionally, we are synchronizing our efforts with NNSA to fully integrate the W80–4 warhead with LRSO. This weapon will retain nuclear penetrating cruise missile capabilities through 2060. To meet operational, testing, and logistics requirements, the Air Force plans to acquire approximately 1,000 LRSO cruise missile bodies. This quantity will provide spares and supply sufficient non-nuclear missile bodies throughout ongoing flight and ground testing. The number of nuclear-armed LRSO cruise missiles (i.e., mated to a nuclear warhead) is expected to be equivalent to the current ALCM nuclear force. Milestone A for LRSO was declared in July 2016.

B61

The B61 family of gravity nuclear weapons support the airborne leg of the Triad and is the primary weapon supporting our NATO allies under extended deterrence. The B61–12 is currently undergoing a Life Extension Program (LEP) and will result in a smaller stockpile, reduced special nuclear material in the inventory, improved B61 surety, and reduced lifecycle costs by consolidating four weapon versions into one. The B61–12 life-extension includes the addition of a digital weapons interface and a guided tail kit assembly. AFGSC is the lead command for the $630 million fiscal year 2018–2022 B61–12 Tail Kit Assembly program, which is needed to meet USSTRATCOM requirements on the B–2. The B61–12 Tail Kit Assembly program is in Engineering and Manufacturing Development Phase 1 and is synchronized with NNSA efforts. The Tail Kit Assembly design and production processes are on schedule and within budget to meet the planned Fiscal Year 2020 First Production Unit date, and support the lead time required for the inclusion of the Department of Energy (DoE) warhead service-life extension completion date of March 2020. This joint DOD and DoE endeavor allows for continued attainment of our strategic requirements and regional commitments.

GBU–57

AFGSC assumed responsibility as the lead MAJCOM for the GBU–57 Massive Ordnance Penetrator (MOP) in the Summer of 2015. The MOP is a 30,000-pound guided conventional bomb designed to defeat hardened and deeply buried targets and is exclusively employed from the B–2. It has received several upgrades and enhancements based on warfighter requirements. AFGSC, USCENTCOM, and the Air Force Life Cycle Management Center Program Office are currently conducting two more enhancements to increase weapon effectiveness.

SECURITY

Nuclear security is a key function of the command's mission, and a major AFGSC security initiative continues to be new Weapon Storage Facilities (WSF). These new facilities will consolidate nuclear maintenance, inspection, and storage into a single modern and secure facility, replacing deficient 1960s-era Weapon Storage Areas. Additionally, this initiative eliminates security, design, and safety deficiencies and improves our maintenance processes. We have put forward a $1.9 billion program to meet requirements for a safe, secure, and effective nuclear arsenal.

NUCLEAR COMMAND, CONTROL, AND COMMUNICATIONS

Air Force Nuclear Command, Control and Communications (NC3) systems connect the President to his senior advisors and to the nuclear forces. The ability to receive presidential orders and convert those orders into actionable directives is both critical to performing the nuclear mission and foundational to an effective and credible strategic deterrent. AFGSC is the Air Force's lead command for National Leadership Command Capabilities (NLCC)/NC3 which establishes one focal point for the weapon system.

AFGSC has taken its charge of sustaining and modernizing the NC3 weapon system seriously. In fact, through the Nuclear Enterprise Review process and a cross-MAJCOM internal Air Force study, we identified multiple areas that have atrophied through decades of low prioritization. To remedy the deterioration, we have advocated for funds specifically for NC3, including $16 million to improve long-haul communications, $8 million in telephony upgrades, and $2 million in radio upgrades. Additionally, AFGSC stood up the USAF NC3 Center in April 2017. The NC3 Center oversees interoperability, standardization, and configuration control of the USAF's NC3 weapon system, and will plan and program for NC3 investment, sustainment, and operations. In standing up the Center, Air Force NC3 finally speaks with a singular voice.

AFGSC has continued to make gains in efforts to modernize our communications and cyberspace infrastructure by leveraging technology, making our forces more capable and effective. In our ICBM fields, some of the copper cabling that transports voice and data between the main base and the Missile Alert Facilities (MAFs) rely on 1960s technology and equipment. We have undertaken a major modernization initiative to replace old cabling with modern technology that will realize over a 15-fold increase in data capability and improve missile field command and control with unclassified and classified networking, wireless networking, and secure digital voice to the MAFs. These are important upgrades, but they still do not replace the buried copper nuclear command and control lines.

When AFGSC was named lead command for NC3, we added the E–4B to our list of aircraft. The E–4B Nightwatch serves as the National Airborne Operations Center and is a key component of the National Military Command System for the President, the Secretary of Defense, and the Joint Chiefs of Staff. In case of national emergency or destruction of ground command and control centers, the aircraft provides a highly survivable command, control and communications center to direct U.S. Forces, execute emergency war orders and coordinate actions by civil authorities.

NUCLEAR ENTERPRISE REVIEW

In 2014, the DOD Nuclear Enterprise Review (NER), along with internal Air Force assessments, served as a catalyst for major improvements within the Air Force nuclear enterprise. Since 2014, the Air Force has applied deliberate and sustained focus towards addressing the identified shortfalls. Our ongoing efforts—spanning the full-range of personnel, management, oversight, mission performance, training, testing, and investment issues—continue to produce tangible and lasting improvements. As this committee is well aware, the Air Force and AFGSC have undertaken monumental shifts to support our number one priority, the nuclear enterprise. Our Airmen continue to see increased emphasis on their mission require-

ments. They see mid-career leaders mentoring those younger than them, educating them on the importance of their missions. They see their most senior leaders in the Administration, in the Department, and here in Congress acting on their behalf.

However, we are not done. Since the NER, we have accomplished bottom-up reviews of our bomber forces, airborne launch operations, and the headquarters itself. Most recently, we created a Human Weapon System Team. All of our major weapon systems have teams which monitor the health and sustainment of the program. We were lacking this kind of approach for the most important weapon system we have ... our airmen! We continue to cultivate a culture that embraces innovation, change, diversity, while fostering an environment of dignity and respect. In order to gauge our progress on improvement, I established an Independent Strategic Assessment Group earlier this year. This group, led by established former leaders of the DOD, is providing me with critical feedback on how we are taking care of our Airmen, how we are structured, and how we can expertly accomplish our deterrence mission. This is a resource I will continue to use in the future as the command evolves.

PRIORITIES

My priorities remain the same and are relatively simple. They guide every decision I make. They are Mission, Airmen, and Families ... rooted in our AF Core Values and reinforced by our rich heritage. We exist to serve the Nation by providing strategic deterrence and global strike. However, without our great Airmen, we could never hope to be as successful as we are. When I visit our units, I am always humbled by the dedication of our Global Strike warriors and their unfailing drive to do their best. I truly believe that while we recruit Airmen, we retain families. We cannot forget the loved ones who stay behind while our Airmen deploy, whether it is overseas or to a missile field. We recognize that no matter the job an Airman is doing, we must never lose sight of the families who support them. This is why I have asked my leadership at all levels to focus on making tangible and lasting improvements in supporting our Airmen and families. We have always made family a top priority, but now we're deliberately focusing on initiatives to care for our Airmen and their families. We are improving the quality and capacity of dormitories across the command and strengthening involvement and engagement with local School Liaison Officers through annual training and regular encounters. We have also looked at how we care for our families and have engaged the Defense Health Agency to enhance the reimbursement rates for Applied Behavioral Analysis Therapy and the Exceptional Family Member Program. We have recognized the sacrifices spouses make when they are required to change duty stations and realize the high rates of under and unemployment. To address this area, we are utilizing military spouse preference hiring authorities, and are also working with Headquarters Air Force on reciprocity agreements to transfer accreditations and licensures (e.g. medical, education) for spouses in these situations to assist in employment opportunities. These efforts ensure that we take special care of our great Airmen and their families.

CONCLUSION

Thank you for your continued support of Air Force Global Strike Command and our strategic deterrence and global strike missions. Fiscal constraints, while posing planning challenges, do not alter the national security landscape or the intent of competitors and potential adversaries; nor do they diminish the enduring value of long range, strategic forces to our nation. The technology and capability gaps between our Nation and its adversaries are closing dangerously fast ... and in some cases, have closed completely.

Although we account for less than one percent of the DOD budget, AFGSC forces represent two-thirds of the nation's nuclear Triad and oversee approximately 75 percent of the nation's NC3 systems. These forces play a critical role in ensuring U.S. national security, while also providing joint commanders rapid global combat airpower. AFGSC will continue to seek innovative, cost-saving measures to ensure our weapon systems are operating as efficiently and effectively as possible. Modernization, however, is mandatory. AFGSC is operating a bomber force averaging over 40 years of age; operating ICBMs with 1960s infrastructure; and utilizing 1960s era weapon storage areas. We cannot afford to delay modernization initiatives. The best way to avoid unthinkable conflict is to deter and be prepared to fight with modern and reliable forces. To do otherwise, by delaying modernization once more, invites strategic instability, potential miscalculation, and the risk of devastating escalation. We stand at a pivotal point in history where the American people and our allies are counting on congressional action to fund our nuclear enterprise modernization efforts. Thank you for your ongoing support of the nuclear enterprise.

Senator FISCHER. Thank you, sir.

Mr. MacStravic, please?

STATEMENT OF JAMES A. MACSTRAVIC, PERFORMING THE DUTIES OF UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY AND LOGISTICS

Mr. MACSTRAVIC. Chairwoman Fischer, Ranking Member Donnelly, thank you for the opportunity to testify on the fiscal year 2018 budget request for nuclear forces. I am pleased to join General Rand, Dr. Soofer, and Vice Admiral Benedict to discuss the Department of Defense's number one mission: maintaining and modernizing a safe, secure, and effective nuclear deterrent.

In my current role, I am responsible for advising the Secretary of Defense and the Deputy Secretary of Defense on all matters concerning acquisition of technology and logistics, including the acquisition and sustainment of our Nation's nuclear forces. I oversee systems acquisition for the nuclear enterprise, lead the Department's efforts to acquire the strategic nuclear weapons delivery and command-and-control systems required to meet the operational needs of our Armed Forces, and serve as the chairman of the Nuclear Weapons Council.

The Nuclear Weapons Council is a joint DOD and Department of Energy/NNSA [National Nuclear Security Agency] council established to facilitate cooperation and coordination, reach consensus, and institute priorities between the two departments as they fulfill their responsibilities for U.S. nuclear weapons stockpile management.

In January, the President directed the DOD to conduct a comprehensive review of the roles of nuclear weapons in our national security, our strategy to fulfill those roles, and the capability requirements to implement that strategy. The Office of the Secretary of Defense and the joint staff are currently leading the Nuclear Posture Review [NPR], and my office is fully engaged.

The NPR will look at all elements of U.S. nuclear forces, policy, and posture to ensure that our nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to meet 21st Century threats.

The Department appreciates Congress' support in ensuring the credibility and reliability of our nuclear deterrent in an increasingly complicated and challenging world, and it is essential that Congress continue the support for the President's fiscal year 2018 budget request for nuclear deterrence forces.

This budget request demonstrates DOD's commitment to strengthening and modernizing an aging nuclear triad. It is very much appreciated that Congress recognizes and supports the challenges facing our nuclear enterprise. Our systems are well past their intended service lives, and we risk losing operational capability, reliability, and effectiveness.

Delaying modernization and warhead life-extension efforts would degrade the effectiveness of these systems and would put at risk the fundamental objective of these systems: nuclear deterrence.

As our delivery systems and warheads reach their limits for sustainability, our choice is not between keeping or updating our forces. Rather, our choice is between modernizing those forces or

watching a slow and unacceptable degradation in our ability to deter adversaries who represent existential threats to our Nation. Because all of our systems require modernization at the same time, we need continued support from Congress to ensure adequate, consistent funding for these programs.

As the DOD moves forward with recapitalization of all three legs of the nuclear triad, and investment in the resilience of the NC3 [Nuclear Command, Control, and Communications] architecture, the total cost to sustain the existing force and field a modernized replacement is projected to range from approximately 3 percent to 6 percent of total defense spending annually. This projection includes the total cost of the strategic delivery systems that have a nuclear-only mission, a portion of the cost of the B–21 bomber, which will have both conventional and nuclear roles, but no longer includes nuclear warhead life extension efforts that are funded by DOE [Deparment of Energy] and NNSA.

Again, we appreciate that Congress has recognized the severity of this problem and is taking steps to ensure adequate resources are made available for continuing these critical modernization efforts.

I want to take this opportunity to thank the committee for its support of the budget in fiscal year 2017. I look forward to your continuing support in fiscal year 2018.

Thank you again for the opportunity to testify. I am happy to answer any questions you may have.

[The prepared statement of Mr. MacStravic follows:]

PREPARED STATEMENT BY MR. JAMES MACSTRAVIC

Chairman Fischer, Ranking Member Donnelly, and distinguished members of the Subcommittee, thank you for the opportunity to testify today on the fiscal year (FY) 2018 budget request for nuclear forces. I am pleased to join General Rand, DASD Soofer, and Vice Admiral Benedict to discuss the Department of Defense's (DOD's) number one mission: maintaining and modernizing a safe, secure, and effective nuclear deterrent.

In my current role, I am responsible for advising the Secretary of Defense and the Deputy Secretary of Defense on all matters concerning acquisition, technology and logistics, including the acquisition and sustainment of our nation's nuclear forces. I oversee systems acquisition for the nuclear enterprise, lead the Department's efforts to acquire the strategic nuclear weapons delivery and command and control systems required to meet the operational needs of our Armed Forces, and serve as Chairman of the Nuclear Weapons Council (NWC). The NWC is a joint DOD and Department of Energy (DOE)/National Nuclear Security Administration (NNSA) council established to facilitate cooperation and coordination, reach consensus, and institute priorities between the two departments as they fulfill their responsibilities for U.S. nuclear weapons stockpile management.

In January, the President directed the DOD to conduct a comprehensive review of the roles of nuclear weapons in our national security, our strategy to fulfill those roles and the capability requirements to implement that strategy. The Office of the Secretary of Defense and the Joint Staff are currently leading the Nuclear Posture Review (NPR), and my office is fully engaged. The NPR will look at all elements of U.S. nuclear forces, policy, and posture to ensure that our nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st Century threats.

The Department appreciates Congress' support in ensuring the credibility and reliability of our nuclear deterrent in an increasingly complicated and challenging world, and it is essential that Congress continue this support for the President's fiscal year 2018 budget request for nuclear deterrence forces. This budget request demonstrates DOD's commitment to strengthening and modernizing an aging Nuclear Triad. Today, I will summarize the DOD and NWC perspectives on, and priorities for, nuclear weapon delivery systems modernization and replacement, warhead

life-extension, stockpile sustainment, nuclear command, control and communication (NC3), and the challenges we face today and tomorrow to ensure a safe, secure, and effective nuclear enterprise.

It is very much appreciated that Congress recognizes and supports the challenges facing our nuclear enterprise. Our systems are well past their intended service lives and we risk losing operational capability, reliability and effectiveness. Delaying modernization and warhead life-extension efforts would degrade the effectiveness of these systems and would put at risk the fundamental objective of these systems—nuclear deterrence. As our delivery systems and warheads reach their limits for sustainability, our choice is not between keeping or updating the current forces. Rather, our choice is between modernizing those forces or watching a slow and unacceptable degradation in our ability to deter adversaries who present existential threats to our nation. Because all of our systems require modernization at the same time, we need continued support from Congress to ensure adequate, consistent funding for these programs. As the DOD moves forward with re-capitalization of all three legs of the nuclear Triad and investment in the resilience of the NC3 architecture, the total cost to sustain the existing force and field a modernized replacement is projected to range from approximately 3 percent to 6 percent of total defense spending annually. This projection includes the total cost of the strategic delivery systems that have a nuclear-only mission, a portion of the cost of the B–21 bomber, which will have both conventional and nuclear roles, but no longer includes nuclear warhead life extension efforts that are funded by DOE/NNSA. Again, we appreciate that Congress has recognized the severity of this problem and is taking steps to ensure adequate resources are made available for continuing these critical modernization efforts.

NUCLEAR SYSTEMS SUSTAINMENT AND MODERNIZATION

It is imperative that system modernization and sustainment efforts continue, or we run the risk of creating critical capability gaps as legacy systems reach the end of sustainability—negatively affecting the credibility of the Nation's strategic deterrent. Almost all of the platforms and delivery systems that comprise the nuclear Triad have already been extended decades beyond their original expected service lives. With the current replacement schedule, there is no remaining margin between legacy system age-out and the planned fielding of modern replacements.

The DOD fiscal year 2018 budget request is consistent with these plans. Enacting it will ensure that current nuclear delivery systems can be sustained and that modernization and replacement programs preclude gaps in capability. However, these programs will require increased investment over current levels for much of the next 20 years.

The Department remains committed to sustaining current nuclear Triad capabilities and will ensure they continue to meet warfighter requirements throughout the transition to modernized delivery systems. The Air Force maintains a detailed plan to execute sustainment activities for the Minuteman III (MMIII) weapon system until the recently initiated Ground-Based Strategic Deterrent (GBSD) system is fielded and operational. Meanwhile, the Air Force is executing a series of four planned life extension programs (LEPs) for the Air-launched Cruise Missile (ALCM) to ensure the system remains operational and effective until replaced by the Long Range Standoff (LRSO) cruise missile in 2030. Further, Air Force continues to maintain the viability of the U.S. strategic bomber force through a series of upgrades to the B–2A and B–52H that will ensure continued survivability and compatibility with modern weaponry. It is imperative that these and other legacy systems remain safe, secure and effective until replaced by modernized deterrent systems.

Beyond sustaining current systems, DOD is implementing a robust plan to recapitalize our strategic nuclear deterrent including ballistic missile submarines, ICBMs, submarine-launched ballistic missiles (SLBMs), ALCMs, nuclear-capable heavy bombers, dual-capable aircraft (DCA), and our NC3 system. Specifically, the fiscal year 2018 budget request continues to fund: the *Columbia*-class submarine program and Trident II (D5) missile Life-Extension; the GBSD; development of the B–21 Bomber; development of LRSO; the B61–12 gravity bomb LEP tail kit; and comprehensive upgrades to NC3.

- I approved initiation of detailed design and construction of the *Columbia*-class ballistic missile submarine program with a Milestone B decision in January 2017. The program requires adequate resources and a stable, predictable funding profile to ensure that construction starts in fiscal year 2021. There is no margin left in the replacement schedule if the Department is to meet the first patrol need date in fiscal year 2031. Any resource or funding shortfalls could delay the delivery of the *Columbia*-class submarines and place the most surviv-

able leg of the Nation's nuclear Triad at risk. Fiscal year 2018 investment funding: $1,870 million.

- GBSD will be fielded as the MMIII ICBM reaches its end of life. The program achieved Milestone A in August 2016 and entered into the Technology Maturation and Risk Reduction (TMRR) Phase. The Air Force is conducting source selection and anticipates awarding contracts to two vendors in the 4th quarter of fiscal year 2017. The fiscal year 2018 President's Budget fully funds the GBSD: that funding must also remain stable if the program is to remain on schedule. Delays to the GBSD schedule will result in capability gaps as the Minuteman III ages. Fiscal year 2018 investment funding: $216 million.
- The Air Force's fiscal year 2018 budget request includes funding for the B–21 bomber and will continue the development of a long-range, highly survivable platform that will provide a visible and flexible nuclear deterrent capability. Nuclear enterprise-related funding is only a small portion of the overall B–21 bomber program. The total fiscal year 2018 investment budget request for the entire B21 program is $2,004 million.
- The LRSO cruise missile will replace the aging ALCM and will improve the flexibility and survivability of the air leg of the Triad. It will have improved penetration capabilities against advanced Integrated Air Defense Systems and in GPS-denied environments from significant standoff ranges. The program successfully achieved Milestone A in July 2016, is currently in TMRR, and anticipates awarding contracts to up to two vendors in the 4th quarter of fiscal year 2017. The first LRSO missile will be delivered in 2026 and the program will meet Initial Operational Capability by 2030. fiscal year 2018 investment funding: $451 million.
- The B61–12 LEP tail kit program is part of the overall B61 LEP. The B61 LEP will provide the strategic weapons for the airborne leg of the nuclear triad that are carried on the B–2 and will be carried on the B–21. The B61 LEP will also provide the nuclear gravity bomb for North Atlantic Treaty Organization (NATO) dual-capable aircraft. DOE/NNSA and the Air Force are jointly executing the effort to refurbish the B61 with the First Production Unit (FPU) scheduled in 2020. The Air Force portion of the LEP will provide the development, acquisition and delivery of a guided tail kit assembly and all up round technical integration, system qualification and fielding. Fiscal year 2018 investment funding (B61–12 LEP Tail kit only): $180 million.
- The fiscal year 2018 budget continues funding the F–35 program, which includes integration of a nuclear delivery capability for the F–35A. The F–35A DCA will maintain a critical capability that is needed for non-strategic nuclear missions in support of the Nation's extended deterrence and assurance commitments, especially to our Allies. Fiscal year 2018 investment funding (F–35A DCA funding only): $35 million.

DOD STOCKPILE ACTIVITIES

The Department is ensuring that the U.S. nuclear stockpile is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st Century threats. We continue to follow the NWC's stockpile strategy, which currently includes development of three interoperable nuclear explosive packages for ballistic missiles and two air-delivered warheads. The Interoperable Warhead 1 will be the first of three ballistic missile warheads under this strategy, and a full feasibility study is planned for completion in the early 2020s.

The NWC remains fully committed to ensuring the viability of each of the three legs of the nuclear Triad and revitalizing the nuclear enterprise. Under the guidance of DOE/NNSA, several weapon systems LEPs are underway to support the Nation's long-term deterrent capabilities. The SLBM-based W76–1 warhead and the B61–12 bomb for the air-delivery systems are the most urgent warhead life-extension needs in our stockpile, and the fiscal year 2018 President's budget request fully funds these LEPs. The W76–1 LEP is on schedule to complete production in fiscal year 2019. The fiscal year 2018 budget also funds sustainment of the SLBM-based W88 warhead through the W88 Alt 370, which was authorized to begin production engineering in February 2017 to replace the aging arming, fuzing, and firing system and refresh the conventional high explosive. That program is on schedule to achieve a December 2019 FPU. The LRSO warhead LEP, designated as the W80–4, is in the Feasibility Study and Design Options development phase. The W80–4 warhead LEP and LRSO cruise missile acquisition communities continue to collaborate and align their concurrent development efforts, with the W80–4 FPU planned for 2025 to support a first missile delivery in 2026.

The greatest challenge facing the NWC is to secure the necessary resources for three critical areas to allow continued certification and ensure our nuclear weapons remain safe, secure, and effective: (1) sustaining and life-extending our stockpile in concert with the modernization of associated delivery systems; (2) sustaining and modernizing our aging nuclear stockpile enterprise infrastructure; and (3) preserving stockpile science and engineering expertise and capabilities. Our nuclear enterprise infrastructure challenges include addressing aged, end-of-life facilities maintenance, recapitalization, and replacement. The NWC focuses specifically on the plutonium, uranium, and tritium capabilities needed to support the current and future nuclear weapons stockpile. The Department reinforces DOE/NNSA's need for responsive and productive plutonium and uranium capabilities, as well as the ability to produce tritium to meet planned stockpile needs. It is imperative that Congress support the full nuclear-related budget requests of both Departments to ensure national security requirements continue to be met.

NC3

Our nuclear deterrent must be appropriately tailored to deter 21st Century threats, and the NC3 system must have similar attributes. The nuclear security environment has changed markedly in the decades since the Cold War. The risk is increasing that non-nuclear states and terrorists, especially those at odds with the United States and its allies and partners, will acquire nuclear weapons and the means to deliver them. Potential adversaries are pursuing both traditional and asymmetric means to threaten U.S. nuclear capabilities and U.S. interests. Aggressive behavior by states like Iran and North Korea threatens regional stability and challenges United States ability to assure allies and partners through extended deterrence.

We will continue to modernize our NC3 systems to take advantage of our areas of technological superiority. The NC3 system must remain strong and resilient to convince adversaries that any attempt to disrupt the President's ability to command our nuclear forces would be futile. Data supporting the NC3 mission must be accessible through all attack phases. Flexible information services will help meet the communications demands of a geographically dispersed infrastructure to ensure data remains accessible. This allows a relatively smooth transition of duties should the crisis force the devolution of operations to alternate locations. Persistent analysis and adaptation will assure links between surviving command centers, networks, and forces even during and after a large-scale nuclear attack on the Homeland.

The NC3 system must be ready, tailored, and flexible to enable deterrence and nuclear response across a wide range of conditions and scenarios, calibrated against specific actors, and adaptable to meet evolving threats and sudden upsets. Deterrence and nuclear response operations may occur in a wide range of scenarios that vary in likelihood and consequence of occurrence. The NC3 system must function to deter nuclear threats ranging from limited use against our allies to existential threats to our Homeland. Components may also adapt to support U.S. policy regarding non-nuclear strategic challenges.

The cost to modernize the NC3 system is included in the DOD nuclear recapitalization costs. Fiscal year 2018 investment funding: $447 million.

CONCLUSION

Nuclear deterrence remains DOD's highest priority, and the President's budget request for fiscal year 2018 reflects the Administration's emphasis on the maintaining a viable and effective nuclear enterprise. Across the FYDP we are making investments in modernization and sustainment across the nuclear enterprise, investments which are critical to ensure the continued safety, security, and effectiveness of our nuclear deterrent as well as the long-term health of the force that supports our nuclear Triad. The President's fiscal year 2018 budget request supports the Nation's nuclear deterrent strategy. It includes $14 billion for nuclear force sustainment and operations and $5 billion for associated recapitalization programs. As the bedrock of our national security, our Nation must remain committed to fully funding the recapitalization of our nuclear forces. The President's fiscal year 2018 budget request demonstrates the Administration's commitment to the sustainment of our deployed legacy nuclear forces and development of modern replacements. These efforts will ensure our nuclear deterrence forces remain an effective foundational element of our strategy for deterring strategic attacks against the U.S, and our Allies and for reducing the risk of large-scale war. I want to take this opportunity to thank the committee for its support of the budget in fiscal year 2017. I look forward to your continuing support in fiscal year 2018. I am happy to answer any questions you may have.

Senator FISCHER. Thank you, sir.

Next, Dr. Soofer, welcome back. It is good to see you.

STATEMENT OF ROBERT M. SOOFER, Ph.D., DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR NUCLEAR AND MISSILE DEFENSE POLICY

Dr. SOOFER. Thank you. Chairwoman Fischer, Ranking Member Donnelly, distinguished members of the committee, thank you for the opportunity to testify on the President's fiscal year 2018 budget request for nuclear forces. Thank you for your kind words.

The President directed the Department of Defense to conduct a comprehensive Nuclear Posture Review, and we expect to complete it by the end of this calendar year. I will not prejudge the outcome of the NPR but will outline some of the challenges and the questions that we face.

For decades, U.S. nuclear forces have provided the ultimate deterrent against nuclear attacks on the United States and our allies. Nuclear weapons remain a foundational element of U.S. strategy for deterring strategic attacks and large-scale war, and for assuring U.S. allies.

Effective deterrence requires a deliberate strategy and forces that are structured and postured to support that strategy within the existing security environment. Strategy, forces, and posture must also be flexible enough to maintain stability while adjusting to both the gradual and rapid technological and geopolitical changes. Recent years have, indeed, brought changes that the U.S. policy must address.

Russia has undertaken aggressive actions against its neighbors that threaten the United States and its allies. It has elevated strategies of nuclear first use. It is violating the landmark Intermediate-Range Nuclear Forces Treaty, and it is modernizing a large and diverse non-strategic nuclear weapons force.

In the Asia-Pacific, China's increased assertiveness suggests a desire to dominate the region. China continues to modernize its rogue mobile and silo-based nuclear missile systems, as well as its ballistic missile submarine weapons system.

North Korea's leadership has demonstrated a willingness to accept economic countermeasures and international isolation in order to advance its nuclear capability and develop ballistic missiles able to strike the U.S. Homeland, as well as our allies in the region.

New threats are emerging from nonnuclear strategic capabilities, most of which are not constrained by treaties or agreements. Technological advancements mean that proliferators might seek weapons of mass destruction development paths that are different from the ones that we are accustomed to detecting and countering.

As we conduct the NPR, Secretary Mattis has directed that we continue with the existing program of record for recapitalizing our aging nuclear forces. After decades of deferred modernization, replacement programs must proceed without further delay, if we are to retain existing deterrent capabilities.

The critical mission of ensuring an effective nuclear deterrent is the highest priority mission of the Department of Defense, and one it shares with the Department of Energy and the Congress. We

look forward to continuing to work together in faithfully and responsibly fulfilling this mission.

Thank you again for the opportunity to testify. I look forward to your questions.

[The prepared statement of Dr. Soofer follows:]

PREPARED STATEMENT BY DR. ROBERT SOOFER

Chairwoman Fischer, Ranking Member Donnelly, and distinguished Members of the Committee, thank you for the opportunity to testify on the President's Fiscal Year (FY) 2018 Budget Request for Nuclear Forces and Atomic Energy Defense Activities.

HISTORICAL DETERRENCE ROLE OF U.S. NUCLEAR WEAPONS

For decades, U.S. nuclear forces have provided the ultimate deterrent against nuclear attacks on the United States and our allies. During the Cold War, nuclear forces also played a key role in deterring the threat of massive conventional attack in Europe and elsewhere. Since the end of the Cold War, nuclear weapons have remained a foundational element of U.S. strategy for deterring strategic attacks and large-scale war, and for assuring U.S. allies, even as the United States worked to reduce the role and salience of nuclear weapons worldwide. It is apparent that, unfortunately, some nations have not followed our lead in reducing the role of nuclear weapons, and have, in some cases, deliberately elevated and expanded the prominence of nuclear weapons in their strategies.

NUCLEAR POSTURE REVIEW

The President directed the Department of Defense (DOD) to conduct a comprehensive review of our nuclear weapons policy. Not surprisingly, an enduring deterrence role for U.S. nuclear forces is explicit in the President's direction. The Nuclear Posture Review (NPR) will look at all elements of U.S. nuclear forces and posture to ensure that our nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st Century threats. The NPR is underway, and we expect to complete it by the end of this calendar year.

The NPR is led by the Office of the Under Secretary of Defense for Policy (OUSD(P)) and the Joint Staff, in direct consultation with the Department of Energy's (DOE) National Nuclear Security Administration (NNSA) and the Department of State. OUSD(P) and Joint Staff leadership are working closely with representatives from the Military Departments, Combatant Commands, and across DOD components. We are also consulting with key allies and partners, other U.S. Government departments and agencies, and appropriate congressional committees.

The 2017 NPR is following a structured and deliberate process to meet the President's direction. That process begins with reviewing and assessing changes in the strategic environment since the last NPR, which was conducted in 2009. We must then determine the roles of nuclear weapons in U.S. national security strategy, develop strategies to fulfill those roles, and assess the capabilities needed to implement U.S. nuclear strategy.

I will not prejudge the outcome of the NPR, but will outline some of the challenges and questions we must consider.

CONTINUITY AND CHANGE IN THE SECURITY ENVIRONMENT

Maintaining effective nuclear deterrence is an absolute imperative, and it is the highest priority mission of the DOD. Effective deterrence requires a deliberate strategy for how to deter and how to communicate messages of resolve and restraint to potential adversaries, and it requires forces that are structured and postured to support that strategy within the existing security environment. Strategy, forces, and posture must also be flexible enough to maintain stability while adjusting to both gradual and rapid technological and geopolitical changes.

The 2017 NPR must consider elements of both continuity and change in the international security environment. There is continuity in the reality that we live in a world with potential adversaries armed with nuclear weapons. Nuclear weapons in the hands of potential adversaries pose the only clear existential threat to the United States, and, likewise, threaten our allies. Russia remains our only near peer in terms of arsenal size, though China also fields a substantial nuclear force. Both Russia and China are actively engaged in extensive programs to modernize their nuclear forces, and are well positioned to retain them for the foreseeable future.

Knowledge about nuclear, chemical, and biological weapons is widespread, and, therefore, we cannot rule out the possibility of further proliferation of weapons of mass destruction (WMD). Finally, there is an element of continuity in the ever-present possibility of impending change, which can appear as a gradual evolution or as rapid upsets.

Recent years have indeed brought changes to the security environment that United States nuclear policy must address. Russia has undertaken aggressive actions against its neighbors and threatened the United States and its NATO Allies—including nuclear threats. It has elevated strategies of nuclear first use in its strategic thinking and military exercises, is modernizing a large and diverse non-strategic nuclear weapons force, and is violating the landmark Intermediate-Range Nuclear Forces (INF) Treaty.

Resolving Russia's INF Treaty violation is a top priority for this Administration. This Administration has been clear with Russia that the status quo is unacceptable and that the United States must therefore consider concrete steps that will deny Russia any significant military advantage from this violation. While our strong preference is for Russia to return to compliance with the Treaty, the United States is prepared to hold Russia accountable and take steps to change Russia's calculus. This is not only to mitigate against the new threats presented by the missiles, but also to ensure arms control agreements remain credible in the future.

Russia presents a significant set of challenges, but is only one element of an increasingly complex global strategic environment. In the Asia-Pacific region, China's increased assertiveness suggests a desire to dominate that region. North Korea's leadership has demonstrated a willingness to accept economic countermeasures and international isolation in order to advance its nuclear capability and develop ballistic missiles able to strike the United States Homeland as well our allies in the region. The United States remains committed to ensuring that Iran never acquires a nuclear weapon. As the Administration conducts its policy review of the Joint Comprehensive Plan of Action (JCPOA), we will continue to meet our commitments under the deal. Iran continues its ballistic missile program, which is outside of the JCPOA.

Across the globe, new threats are emerging from non-nuclear strategic capabilities, most of which are not constrained by treaties or other agreements. These include conventional ballistic missiles, offensive capabilities within the space and cyber domains, and the potential for hypersonic weapons armed with non-nuclear as well as nuclear munitions. Technological advancements mean that future proliferators might seek and find WMD development paths that are different from those we are used to detecting and countering. Finally, existing nuclear weapon States might pursue new means for delivering nuclear weapons, and for defeating U.S. nuclear forces through active defenses or counterforce attacks.

NUCLEAR FORCES AND POSTURE FOR IMPLEMENTING U.S. DETERRENCE STRATEGY

It is against this backdrop that the President directed DOD to ensure that the U.S. nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st Century threats. Each of these characteristics contributes to the effectiveness of our deterrence strategy. Modern nuclear forces would incorporate 21st Century technology, whereas the current U.S. arsenal relies on aging technology that, in some cases, dates back more than half a century. A robust deterrent is strong and able to convince a range of potential adversaries with varying perceptions and values that the risks in attacking the United States or its allies far outweigh any expected benefits. A resilient deterrent is stable, such that plausible changes in adversary strategy, forces, and posture would not create or expose vulnerability in our ability to deter attack. A ready deterrent is postured to enable rapid response across a wide range of conditions and scenarios, thereby further enhancing stability. A tailored deterrent is one that is calibrated to the specific actors and conditions we see today and would expect to see in the near-term, and a flexible deterrent is one that can be adapted further to meet evolving threats and sudden upsets.

Prior reviews across multiple Administrations determined that the surest way to maintain stable and effective nuclear deterrence is to sustain a full triad of land-based intercontinental ballistic missiles (ICBMs), ballistic-missile submarines (SSBNs), and strategic bombers, together with dual-capable fighter aircraft (DCA) equipped to employ nonstrategic nuclear weapons. Each leg of the triad provides unique and complementary capabilities that, together, enable and protect the credibility, flexibility, and survivability of the U.S. deterrent. Each leg also provides a hedge against technical problems or changes in the security environment.

As we conduct the NPR, Secretary Mattis has directed that we continue with the existing Program of Record for recapitalizing our aging strategic triad; dual-capable aircraft; Nuclear Command, Control, and Communications (NC3) systems; and supporting infrastructure. After decades of deferred modernization following the end of the Cold War, most of our current systems are well past their planned service lives. Replacement and modernization programs for strategic delivery and NC3 systems must proceed without further delay if we are to retain existing deterrent capabilities. Similarly, significant delays in delivering a nuclear capability for the F–35 aircraft would create gaps in the ability of the United States and its NATO Allies to support U.S. and Alliance nuclear posture. Nuclear warhead life extension programs (LEPs), together with supporting stewardship activities and infrastructure modernization, must also continue apace to ensure the continued effectiveness of U.S. deterrent forces.

DOD will continue to coordinate with DOE's National Nuclear Security Administration (NNSA) to ensure that programs for warheads and delivery systems are integrated and well aligned. Close and effective coordination between the Departments is one key measure of the overall health of the nuclear enterprise. Maintaining that health also requires stable and adequate funding for both DOD and DOE/NNSA.

COST OF NUCLEAR RECAPITALIZATION

The nuclear enterprise is affordable if nuclear deterrence is prioritized appropriately. During the coming period of increased recapitalization spending, nuclear forces will remain a small fraction of the DOD budget—with annual funding levels that are projected to range from approximately 3 percent to 6 percent of total defense spending. This includes spending to sustain and operate the existing force—currently about $12 to $14 billion per year—as well as recapitalization spending to develop and field modernized replacements.

DOD expects nuclear recapitalization costs to total approximately $230–$290 billion spread over more than two decades, from fiscal year 2018 to fiscal year 2040, in constant fiscal year 2018 dollars. This projection includes the total cost of strategic delivery systems that have a nuclear-only mission, and a portion of the cost of the B–21 bomber, which will have both conventional and nuclear roles. The fraction of the B–21 cost DOD apportions to the nuclear mission is consistent with the historical cost of delivering nuclear capability to a strategic aircraft. The DOD projection for total recapitalization cost also includes modernizing NC3 systems.

Previous DOD projections of $350 to $450 billion for nuclear recapitalization included the full cost of the B–21 bomber, even though the planned size of the bomber force is determined entirely by its conventional mission. The previous projections also included DOD outyear planning funds that were reallocated in each budget request to DOE/NNSA to support nuclear warhead LEPs and other stockpile activities. Beginning in fiscal year 2018, these funds will be accounted for in NNSA budget requests rather than in DOD's. Finally, the updated total of $230 to $290 billion also reflects program progress that has been made in fiscal year 2017 and refinements in cost projections for individual programs.

Public mischaracterizations of non-DOD reports have in some cases created confusion about nuclear recapitalization costs. This is particularly true for studies that included in their estimates nuclear force sustainment and operations in addition to recapitalization, but are often characterized as projecting costs for recapitalization alone. For example, the Congressional Budget Office (CBO) released a report in February 2017 that projected $400 billion for the full cost of U.S. nuclear forces over the next 10 years. In addition to the DOD recapitalization programs that I outlined a moment ago, the CBO estimate includes force sustainment and operations; all NNSA weapons activities, including warhead LEPs and infrastructure; and a projected cost growth of 16 percent.

In making these long-term cost projections, there are always legitimate questions about what to include, what timeframe to cover, and what level of uncertainty is reasonable to expect. DOD is committed to taking a responsible approach to budgeting for nuclear force sustainment and recapitalization. We believe that the President's budget request for the current fiscal year and the five-year Future Years Defense Plan (FYDP) provides the most reliable assessment of these costs.

PRESIDENT'S BUDGET REQUEST FOR NUCLEAR FORCES

The President's Budget Request (PBR) for fiscal year 2018 and the FYDP provide for sustainment and operation of our existing nuclear forces, and fully fund the DOD nuclear recapitalization Program of Record. Future budget submissions will reflect any policy and program adjustments resulting from the NPR.

The portion of the PBR dedicated towards the DOD nuclear enterprise for fiscal year 2018 is $19 billion, which includes $14 billion for nuclear force sustainment and operations and $5 billion for associated recapitalization programs. It funds the *Columbia*-class SSBN to replace the current *Ohio*-class SSBN; the Ground-Based Strategic Deterrent (GBSD) to replace the Minuteman III ICBM; the B–21 next-generation penetrating bomber; the Long-Range Standoff (LRSO) cruise missile to replace the AGM–86B Air-Launched Cruise Missile (ALCM); the DOD portion of the B61–12 nuclear gravity bomb, which will consolidate and replace several existing gravity bomb variants; and modernized NC3 systems. Over the FYDP, the fiscal year 2018 PBR funds nuclear recapitalization programs at a total of $43 billion.

The PBR for fiscal year 2018 incrementally funds the first *Columbia*-class SSBN, which requires average ship construction funding of about $5 billion per year from fiscal year fiscal year 2021 to fiscal year 2025. It funds the GBSD Program at $0.2 billion in fiscal year 2018, increasing to $2.5 billion in fiscal year 2022. It also fully funds the B–21 bomber at an average of $2.7 billion per year in the FYDP, a portion of which is attributed to nuclear modernization, and the LRSO at an average of $0.5 billion per year. The President's fiscal year 2018 budget adds more than $3 billion across the FYDP, relative to the previous year's request, to continue implementing recommendations from the 2014 Nuclear Enterprise Reviews for improving the health of the DOD nuclear enterprise. This includes $2.8 billion in increased funding for the ICBM and sea-based deterrent programs, and about $500 million for the program to replace ICBM security helicopters.

These investments demonstrate the President's commitment to nuclear deterrence and national defense. The critical mission of ensuring an effective nuclear deterrent is one that the Department of Defense shares with the DOE/NNSA and the Congress. We look forward to continuing to work together in faithfully and responsibly fulfilling this mission, and we look forward to congressional and allied input as we conduct the NPR. Thank you, again, for the opportunity to testify. I look forward to your questions.

Senator FISCHER. Thank you very much.

Admiral Benedict, welcome.

STATEMENT OF VICE ADMIRAL TERRY J. BENEDICT, USN, DIRECTOR, STRATEGIC SYSTEMS PROGRAMS

Admiral BENEDICT. Thank you. Chairman Fischer, Ranking Member Donnelly, distinguished members of the committee, thank you for the opportunity to testify today representing the men and the women of your Navy's Strategic Systems Programs. Your continued support of our defense mission is appreciated, and everyone thanks you.

My written statement, which I respectfully request be submitted for the record, addresses my top priorities in detail. I would like to briefly address the long-term sustainment of the sea-based leg of the triad.

While our current life extension efforts will sustain the D5 system until the 2040s, the Navy is already beginning to evaluate options to maintain a credible and effective strategic weapons system to the end of the *Columbia*-class service life in the 2080s.

I remain strongly committed to the concept of intelligent commonality and the sharing of information with the United States Air Force as a method to reduce cost and risk.

At SSP [Strategic Systems Programs], we will continue to look long-term and across the spectrum, from our work force and infrastructure to our industrial partners and our sister services and to our geographic footprint in order to maintain our demonstrated performance.

Thank you for the opportunity to testify today about the sea-based leg of the triad and the vital role it plays in our national security. At this time, I am pleased to answer your questions.

[The prepared statement of Admiral Benedict follows:]

PREPARED STATEMENT BY VICE ADMIRAL TERRY BENEDICT

INTRODUCTION

Chairman Fischer, Ranking Member Donnelly, distinguished Members of the subcommittee, thank you for this opportunity to discuss the sea-based leg of the triad. It is an honor to testify before you this morning representing the Navy's Strategic Systems Programs (SSP).

The nation's nuclear triad of intercontinental ballistic missiles, strategic bombers, and submarine launched ballistic missiles is essential to our ability to deter warfare with major adversaries and assure our allies. The Navy provides the most survivable leg of the triad with our ballistic missile submarines (SSBNs) and the Trident II (D5) strategic weapon system (SWS). Submarine launched ballistic missiles (SLBMs) are responsible for a significant majority of the nation's operationally deployed nuclear warheads. The Chief of Naval Operations (CNO) states that sea-based strategic deterrence is the Navy's number one priority. In order to execute this mission, we must sustain all elements of the undersea leg of the triad including the submarine, the propulsion system, and the SWS.

SSP's mission is to design, develop, produce, support, and ensure the safety of our Navy's sea-based strategic deterrent, the Trident II (D5) SWS. The men and women of SSP and our industry partners remain dedicated to supporting the mission of our Sailors on strategic deterrent patrol and our Marines, Sailors, and Coast Guardsmen who stand watch, ensuring the security of the weapons we are entrusted with by this nation.

Sustaining the sea-based strategic deterrent capability is a vital national requirement today and into the foreseeable future. Our fiscal year 2018 budget request provides the required funding to support the program of record for the Trident II (D5) SWS. To sustain this capability, I am focusing on my top priorities: Safety and Security; the Trident II (D5) SWS Life Extension Program; the *Columbia*-class Program; the Solid Rocket Motor Industrial Base; the Navy Nuclear Deterrence Mission Oversight responsibility; and collaboration with the Air Force.

SAFETY AND SECURITY

The first priority, and the most important, is the safety and security of the Navy's nuclear weapons. Accordingly, Navy leadership delegated and defined SSP's role as the program manager and technical authority for the Navy's nuclear weapons.

At its most basic level, this priority is the physical security of one of our nation's most valuable assets. Our Marines and Navy Masters at Arms provide an effective and integrated elite security force at our two Strategic Weapons Facilities and Waterfront Restricted Areas in Kings Bay, Georgia, and Bangor, Washington. U.S. Coast Guard Maritime Force Protection Units have been commissioned at both facilities to protect our submarines. Together, the Navy, Marine Corps, and Coast Guard team form the foundation of our security program, while headquarters staff ensures that nuclear weapons-capable activities comply with safety and security standards.

The Navy maintains a culture of self-assessment in order to ensure safety and security. This is accomplished through biennial assessments, periodic technical evaluations, formal inspections, and continuous on-site monitoring and reporting at the Strategic Weapons Facilities. The Department of the Navy completed its most recent biennial self-assessment in 2016. The department's self-assessment efforts have shown a continued focus on compliance and improvement in the oversight of our execution of the Navy Nuclear Deterrence Mission (NNDM). We also strive to maintain a culture of excellence to achieve the highest standards of performance and integrity for personnel supporting the strategic deterrent mission and continue to focus on the custody and accountability of the assets entrusted to the Navy. SSP's number one priority is to maintain a safe and secure strategic deterrent.

D5 LIFE EXTENSION PROGRAM

The next priority is SSP's life extension effort to ensure the Trident II (D5) SWS remains an effective and reliable sea-based deterrent.

The Trident II (D5) SWS has been deployed on our *Ohio*-class ballistic missile submarines for 27 years and is planned for a service life of more than 50 years. This is well beyond its original design life of 25 years and more than double the historical service life of any previous sea-based strategic deterrent system. As a result, SSP is extending the life of the Trident II (D5) SWS to match the *Ohio*-class submarine

service life and to serve as the initial payload for the *Columbia*-class SSBN. This is being accomplished through an update to all the Trident II (D5) SWS subsystems: launcher, navigation, fire control, guidance, missile, and reentry. Our flight hardware—missile and guidance—life extension efforts are designed to meet the same form, fit, and function of the original system to keep the deployed system as one homogeneous population, control costs, and sustain the demonstrated performance of the system.

The Navy's D5 life extension program remains on track. In February, the first two D5 life-extended missiles were outloaded onto the USS *Maryland* (SSBN 738). This was a significant programmatic achievement and represents the first step to convert the entire Fleet to life extended missiles over the coming years.

We also reached another milestone in our program earlier this year. In February, we conducted the last Follow-On Commander Evaluation Test (FCET) of the legacy Trident II (D5) missile, involving the flight test of four missiles. The FCET program was established to obtain and monitor, under representative tactical conditions, valid operational reliability, accuracy, and other performance planning factors. We started the D5 FCET program nearly 25 years ago and now have young engineers supporting the program who were born after the FCET program began. We will begin the Commander Evaluation Test (CET) program next year to measure the performance and ability of the life-extended missile to meet demonstrated requirements.

Another major step to ensure the continued sustainment of our SWS is the SSP Shipboard Integration (SSI) Program, which manages obsolescence and modernizes SWS shipboard systems through the use of open architecture design and commercial off-the-shelf hardware and software. The SSI Program includes refreshes of shipboard electronics hardware and software upgrades, which will extend service life, enable more efficient and affordable future maintenance of the SWS, and ensure we continue to provide the highest level of nuclear weapons safety and security for our deployed SSBNs while meeting STRATCOM requirements. Thirty installations were completed in 2016; six have been completed so far this year with an additional fifteen planned.

The Navy also works in partnership with the Department of Energy's National Nuclear Security Administration to sustain our reentry systems. The Trident II (D5) is capable of carrying two types of warheads, the W76 and the W88. Both warheads are being refurbished. The W76 life extension program is approximately 80 percent complete, and the W88 major alteration program remains on track to support a first production unit in calendar year 2019.

The Trident II (D5) SWS continues to demonstrate itself as a credible deterrent and exceeds operational system requirements established more than 30 years ago. Our life extension efforts will sustain a credible strategic weapon system until the 2040s. The Navy is also beginning to evaluate options to maintain a credible and effective strategic weapon system to the end of the *Columbia*-class SSBN service life in the 2080s. SSP has a history of more than 60 years of developing, producing, and supporting strategic weapon systems to support the undersea leg of the triad. We have optimized our SWS and applied lessons learned from six generations of missiles and will continue to do so until the 2080s.

COLUMBIA-CLASS PROGRAM

The Navy's highest priority acquisition program is the *Columbia*-class Program, which replaces the existing *Ohio*-class submarines. The continued assurance of our sea-based strategic deterrent requires a credible SWS, as well as the development of the next class of ballistic missile submarines. The Navy is taking the necessary steps to ensure the *Columbia* SSBN is designed, built, delivered, and tested on time with the right capabilities at an affordable cost.

To lower development costs and leverage the proven reliability of the Trident II (D5) SWS, the *Columbia* SSBN will enter service with the life-extended Trident II (D5) SWS. These D5 LE missiles will be shared with the *Ohio*-class submarines until their retirement. Maintaining one SWS during the transition to the *Columbia*-class is beneficial from a cost, performance, and risk reduction standpoint.

A critical component of the *Columbia*-class program is the development of a Common Missile Compartment (CMC). The U.S. and the UK, one of our closest allies, have maintained a shared commitment to nuclear deterrence through the Polaris Sales Agreement since April 1963. Today, the Trident II (D5) SWS is shared with the UK. Like the U.S. Navy, the UK is recapitalizing her four *Vanguard*-class submarines with the *Dreadnought*-class. We developed a CMC that will support production in both U.S. and UK build yards. The CMC will allow the life extended Trident

II (D5) missile to be deployed on the *Columbia* and the UK *Dreadnought*-class SSBNs.

In 2015, we began construction of missile tubes to support building the U.S. prototype Quad-pack module, the Strategic Weapons System—Ashore (SWS Ashore) test site, and the UK's first SSBN. The joint CMC effort is shifting from design to construction. Any delay to the CMC effort has the potential to impact the UK's ability to maintain a continuous at sea deterrent posture.

To manage and mitigate technical risk to both the U.S. and UK programs, SSP is leading the development of the SWS Ashore integration test site at Cape Canaveral, Florida. This is a joint effort with the Navy and the State of Florida investing in the redevelopment of a Polaris site to conduct integration testing and verification for *Columbia* and UK *Dreadnought* programs. We reached a programmatic milestone in April when test bay one reached initial operating capability.

To mitigate the risk in the restart of launcher system production, SSP developed a surface launch test facility at the Naval Air Warfare Center Weapons Division, China Lake, California. This facility will prove that the launcher industrial base can replicate the performance of the *Ohio*-class Trident II (D5) launcher system. To do so, we will launch the refurbished Trident II (D5) test shapes originally used in the 1980s starting later in June.

The *Ohio*-class will start to decommission in the late 2020s and the *Columbia*-class must be ready to start patrol in fiscal year 2031 to maintain a minimum operational force of 10 SSBNs. The Navy has already extended the *Ohio*-class service life from 30 years to 42 years and there is no engineering margin left. Recapitalizing our ballistic missile submarines is a significant investment and something that happens every other generation, making it critically important that we do it right. Any delay has the potential to impact not only our ability to meet our operational requirements but also the UK's ability to maintain a continuous at sea deterrent posture.

SOLID ROCKET MOTOR INDUSTRIAL BASE

The defense and aerospace industrial base—in particular the solid rocket motor industry and its sub-tier supplier base—is another important priority. I remain concerned with the state of the solid rocket motor manufacturers as well as their suppliers of critical constituents. While the Navy is maintaining a continuous production capability of rocket motors, the demand from both NASA and the Air Force has precipitously declined. This decline has resulted in higher costs for the Navy and has put an entire specialized industry at risk of extinction. To allow this puts our national security at risk. Though future Air Force modernization will provide some relief beginning in the mid-2020s, the Navy cannot shoulder these costs in the interim, nor can our Nation afford to lose this capability. While the efforts of our industry partners and others have created short-term cost relief, the long-term support of the solid rocket motor industry, including its sub-tier supplier base, and maintenance of critical skills remains an issue that must be addressed. At SSP, we will continue to work with our industry partners, DOD, senior NASA leadership, Air Force, and Congress to do everything we can to ensure this vital national security industry asset is preserved.

NAVY NUCLEAR DETERRENCE OVERSIGHT RESPONSIBILITY

As a result of the Nuclear Enterprise Review, the Navy implemented a centralized oversight authority for nuclear force readiness. As the Director of Strategic Systems Programs, I have accountability, responsibility, and authority to serve as the single Flag Officer to monitor performance and conduct end-to-end assessments of the Navy Nuclear Deterrence Mission (NNDM) elements and report issues to the Navy Nuclear Deterrence Mission Oversight Council and the CNO. As the NNDM regulatory lead, I am tasked with developing, coordinating, and implementing policies approved by the CNO; and conducting end-to-end assessments of the Navy's nuclear weapons and nuclear weapons systems and personnel, including Nuclear Command, Control, and Communications (NC3), for safe, reliable, and effective execution of the NNDM. In October 2016, I submitted the first annual end-to-end assessment report to the CNO, and I assessed that the NNDM execution was effective and sustainable with some areas for improvement.

COLLABORATION WITH THE AIR FORCE

The final priority is strategic collaboration between the Services. The Navy and the Air Force are both addressing the challenges of sustaining aging strategic weapon systems and are collaboratively working to ensure these capabilities are retained

in the long-term to meet mission requirements. Many of the industries and required engineering skills sets are unique to strategic systems.

In March 2016, a joint Air Force/Navy team assessed opportunities for commonality between the Ground Based Strategic Deterrent (GBSD) and the Trident II (D5) program. The team identified commonality candidate areas for GBSD. The use of these candidates offers significant potential benefits in terms of reducing costs and technical and schedule risks to the GBSD and SLBM programs. Commonality will provide the Navy and Air Force opportunities to eliminate redundant efforts, leverage economies of scale, and sustain shared critical skills and capabilities needed by securing the industrial base. We anticipate industry will incorporate commonality into their GBSD proposals. Navy also will collaborate to leverage GBSD investments for future SLBM recapitalization.

Each leg of the triad provides unique attributes. Furthermore, a sustained and ready triad provides an effective hedge, allowing the Nation to shift to another leg, if necessary, due to unforeseen technical problems or vulnerabilities. For this reason, the Department is focused on cooperative efforts that maintain affordability and reduce risk to both services, while retaining essential diversity where needed to ensure a credible and reliable deterrent.

CONCLUSION

SSP ensures a safe, secure, and effective strategic deterrent and focuses on the custody and accountability of the nuclear assets entrusted to the Navy. Our nation's sea-based deterrent has been a critical component of our national security since the 1950s and must continue to assure our allies and deter potential adversaries well into the future. I am privileged to represent this unique organization as we work to serve the best interests of our great nation. I thank the committee for the opportunity to speak with you about the sea-based leg of the triad and the vital role it plays in our national security.

Senator FISCHER. My thanks to all of the panel for your opening statements.

General Rand, some observers have suggested extending the life of the current Minuteman system as a cheaper alternative to fielding the GBSD [Ground-Based Strategic Deterrent]. Putting aside the technical and operational reasons why the GBSD is necessary, would SLEPing [Shelf-Life Extension Program] Minuteman-III actually be cheaper for us?

General RAND. Ma'am, the short answer is no. Our analysis is, over the 50-year lifespan of GBSD, it will be $159 billion, and the SLEP of the current Minuteman-III during that same period would be $160.3 billion. It is a $1.1 billion difference.

So just simply from financial, there is no benefit there.

Senator FISCHER. Okay. Let's address some other reasons then, beyond the cost. Why can't the current system be extended past that 2036 date? Why do you believe that?

General RAND. Very good question. Thank you for the opportunity.

I have boiled down deterrence. To me, it has to have three elements to it. To deter the weapon that you use, you need to be reliable. The weapons that you use need to be able to be survivable and get to the target they are intended for and destroy the target. Three, there has to be will.

In both cases with our current Minuteman-III, reliability and survivability is becoming increasingly difficult to do. If we were to continue with the Minuteman-III, we would have to replace the missile. There are attrition problems that we will have with the booster, with missile guidance in the post-booster vehicle that will require us to replace the missile.

So if we came up with 21st Century technology for a missile that we are replacing, and we are going to use 1970s and 1980s tech-

nology for command and control of that, it will be very technically difficult to do, and it will be very expensive to do.

So those are the simple reasons. This is a wonderful system that has now reached its retirement.

Senator FISCHER. We have to look to the future on what is going to keep us safe, correct?

General RAND. Yes, ma'am. Again, as I said, the enemy gets a vote in the survivability piece. We own the reliability piece. Our airmen will move mountains to make sure the Minuteman-III is reliable. But it is, will the weapon get to its intended target? That gap is closing with each passing year, because the enemy's capabilities are improving.

Senator FISCHER. Thank you, sir.

Dr. Soofer, opponents of the modernization program laid out by President Obama, they often criticize it as propagating Cold War-era thinking, and they point specifically to his decision to retain the triad as evidence of this.

General Selva, who is the Vice Chair of the Joint Chiefs, responded to this argument earlier this year in testimony before the House Armed Services Committee, and he noted that the triad had been examined by the Joint Staff three times in the last 5 years, and each evaluation resulted in the same conclusion, that we need to retain the triad.

Can you speak to this notion that our nuclear forces are based on outdated requirements? Isn't it true that, across-the-board, the size, composition, posture, and the policies relating to our nuclear forces have been updated continuously by each administration?

Dr. SOOFER. Thank you, Senator. You are absolutely right.

This is what the previous administration had found. We are in the process of reevaluating that as well in our Nuclear Posture Review. But I think it is safe to say that the triad will remain the basis of our policies going forward.

We have at least three fundamental roles for nuclear weapons that have endured since the days of the Cold War and the post-Cold War period, and that is to deter nuclear attack, to help deter large-scale aggression, and to assure our allies. To do that, we have relied on a triad of forces to provide the flexibility to do that and also to ensure survivability against potential changes in the geopolitical environment or technology, or the adversary being able to, say, be able to take out one leg of the triad or two legs of the triad. If you have three legs, it becomes much more difficult for them to even imagine launching a first strike against U.S. Forces.

Senator FISCHER. For your personal opinion, do you believe we are on the right path with regards to geopolitical changes that we are seeing in the world right now?

Dr. SOOFER. We have already begun the analysis in the Nuclear Posture Review, and we started out with a look at the strategic environment. What has changed since 2010? The differences are vast.

Just to begin with, Russia becoming a great power adversary. The other conclusion that we are quickly coming to is that, despite the fact that Republican and Democratic presidents since the end of the Cold War have been trying to reduce reliance on nuclear weapons, other countries are going in the other direction. Russia, China, North Korea, other countries are increasing reliance on nu-

clear weapons. So we have to take that into account in the way we evaluate our future nuclear requirements.

Senator FISCHER. As we look at the modernization program that we have in place, which we have been told is on schedule, is that enough?

Dr. SOOFER. Senator, honestly, I do not know. This is the purpose of the Nuclear Posture Review, and we want to take a look at all these new developments. I think you have been in some of the classified hearings with General Hyten and others, and you have seen what the Russians are doing in the way of novel nuclear weapons systems. You have seen the expansion of Chinese capabilities.

We have to take a good, hard look and determine whether the current program of record is sufficient or whether changes need to be made. I just cannot prejudge that at this time.

Senator FISCHER. Thank you.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

I want to start by addressing an issue that I think is too often overlooked and may be reaching a critical point as we move forward with our nuclear modernization efforts. That would be the availability of affordable U.S.-manufactured, high-reliability, radiation-hardened microelectronics. This industry has increasingly moved offshore, and we are coming to a point where that may pose a real problem for the Department.

Admiral Benedict, you have worked extensively with the Honeywell facility to conduct a long-term buy of their strategic radiation-hardened microelectronics for your D5 Life Extension Program. Now that your program is completing its procurements from Honeywell, my understanding is there will be a gap before future DOD programs will require these unique trusted parts. That adds serious risk to the viability of this critical capability.

What I am wondering is, can you tell the subcommittee, from your viewpoint, how serious an issue this is, Admiral?

Admiral BENEDICT. Thank you, sir.

I believe it is a very serious issue. As we did the D5 Life Extension, we went to extreme measures within the program to try to optimize the infrastructure that existed within the United States at that time, to the point where we combined the requirements from the guidance subsystems as well as the requirements from the missile subsystems, both of which are required to meet nuclear radiation-hardened levels versus sunbelt or space-hardened, which are much lower in comparison.

We did that, and then we went to a life of type buy in the shortest period that we could fiscally afford within the program, in order to optimize the infrastructure that existed today. We drew extensively from the experience and expertise and talent pool that exists at Crane, as part of the Naval Surface Warfare Center, to optimize that.

Then in support of the Air Force, as they started their GBSD competition, we provided the United States Air Force the entire radiation-hardened electronics database that we built through the Navy's life-extension effort as a means to jumpstart that effort

within the Air Force and cost avoid the Air Force's efforts to reconstitute that from scratch.

So we stand with you in your concern. Again, there is a lull here for a period of years until the Air Force comes through their GBSD down-select and ultimate award, at which point they will need to draw from that type of capability. The question will be, what will be left?

Senator DONNELLY. Mr. MacStravic, I would love to hear what you have to say.

Mr. MACSTRAVIC. So——

Senator DONNELLY. Okay, is there more?

Mr. MACSTRAVIC. There is more. So, sir, you are talking about a systemic problem. Access to secure, trusted, and radiation-hardened microelectronics is a critical requirement for both the Department of Defense and the Department of Energy. The fiscal year 2018 President's Budget has a down payment on making sure that the Nation has an assured supply of advanced electronics, fostering a next generation of both strategic and nonstrategic weapons.

I believe it is going to take a rather long time for us to ensure that we have a robust infrastructure. But we are paying particular attention to both near-term shortfalls in the availability of components and the long-term availability of the core technologies we are going to need to be able to dominate this war space.

Senator DONNELLY. Admiral Benedict and General Rand, I know you are both well-aware of the work that Naval Surface Warfare Center Crane is doing with both SSP and the Air Force to adapt the successful parts program developed for the Trident Life Extension to support the acquisition of GBSD.

I look at the role Crane is playing, and I look at the problem we may face with Honeywell. It seems clear that, if we are going to be undertaking all of these nuclear modernization efforts, all of which have unique requirements for radiation-hardened, high-reliability parts, we should probably be coordinating our acquisition strategy across programs to try to smooth the requirements from program to program and sustain critical capabilities in the services and industrial base.

Mr. Soofer, Mr. MacStravic, what are your views on this, on the more commonality, the more opportunities as we coordinate our acquisition strategy, the more chance we have to sustain these capabilities?

Dr. Soofer?

Dr. SOOFER. Senator, this would just be my personal view. Again, we will be evaluating this in the context of the Nuclear Posture Review.

So commonality can be helpful if it saves money, but if you have too much commonality and something goes wrong with a common part, then you are opening yourself to a potential vulnerability.

Senator DONNELLY. How about the coordination of acquisition strategy, so that we can maintain some of these critical locations?

Dr. SOOFER. May I turn that over to the acquisition expert?

Senator DONNELLY. Sure.

Mr. MACSTRAVIC. So the short answer is yes. In fact, we are doing that.

The acquisition strategy for GBSD is predicated on a wide raft of information that was available, provided by SSP, and informed all potential offers on opportunities, technological as well as material, for enhancing commonality, reducing cost, improving performance.

Once the Air Force has received the proposals and made an award, my office will be conducting, and conducts annually, a critical industrial base assessment, to determine whether or not the design—and remember, all we are rewarding with GBSD is a design—is going to cause additional stress or additional opportunities for critical suppliers at the second and third tier, which is where these components would be performed.

So in addition to making sure that there is mutually conforming acquisition strategies, my office ensures that acquisition execution does not accidentally create gaps in capability or systems.

Senator DONNELLY. General, I was going to ask you the same, but I am almost out of time, so I want to ask you something else.

I understand you are planning a longer life for the B–52, perhaps out to 2050. What is your view on the need to modernize the engines, if we are going to do that?

General RAND. Thank you, Senator.

I think it is one of my top priorities that I would like to pursue with the Department of the Air Force, and that I am. There are many benefits to this, strategic and tactical and operational level. The biggest one is we will have a 30 percent efficiency and increased time on station.

That would reduce significantly our requirement for tankers, and they could be used by other airplanes that needed the tankers. Also, if we reused the engines today, typically have a lifespan of 40, 50 years where you can mount them and not take them off the wing again. That would reduce our manpower requirements that we spend quite a bit of time in the sustainment of the engines. As faithful as the TF33 engine has been, it takes a lot of people and a lot of maintenance to keep it airworthy.

I think that, for those reasons, and the fact that we are going to be flying the B–52 out to 2050, I think there is a lot of value in assessing this.

Senator DONNELLY. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Senator Peters?

Senator PETERS. Thank you, Madam Chair, for holding this hearing.

To our witnesses, thank you for your testimony this afternoon. We certainly do appreciate it.

Dr. Soofer, I would like to ask about the Ballistic Missile Defense Review, in particular, and the environmental impact statements that are being conducted by the Missile Defense Agency.

My understanding is that the environmental impact statement is very far along in the process, if it has not already been completed, which it may have, and it was due to be released last year, actually. However, Deputy Secretary Work informed the Armed Services Committee that because the topic of a potential future interceptor site will be addressed in the review, the Department will

hold off on making a designation of a preferred site for a continental U.S. interceptor site.

As you know, the EIS [Environmental Impact Statement] was required in the fiscal year 2013 NDAA, so if a decision is made to move forward with the interceptor site, the initial environmental review is already complete. I believe the findings of that EIS would be very helpful and very useful in informing the review about the potential cost of environmental mitigation on those sites.

Could you explain to me, please, why the EIS for the interceptor site cannot be released until the review is completed?

Dr. SOOFER. Senator, I do not know why it cannot be released. I will take that back for action.

You are correct. It has been completed. You are also correct that it is going to be factored into the Ballistic Missile Defense Review to see whether we even need an East Coast missile defense site.

But if I can get back to you, sir, I will find out why it cannot be released. Or, if it can be released, get it to you as soon as possible.

Senator PETERS. I would appreciate that, if you could do that. I appreciate that it is going to be considered in the overall review in the assessment.

If I take that a step further, will the assessment utilize the findings on a potential site, in looking at a potential site that may be the lowest cost or the least impacted, that that will be a significant factor in which site is selected?

Dr. SOOFER. Senator, I think at the level of the BMDR [Ballistic Missile Defense Review], we will ask the question of whether we need an East Coast site, how many interceptors we might need. But the determination of where that site would be may not be considered at the level of the Ballistic Missile Defense Review.

Senator PETERS. Right. So that would be at the next level then, as you are evaluating specific sites.

Dr. SOOFER. Exactly right.

Senator PETERS. It is part of the broader review, so obviously, it is a critical component of the overall decision that will be made both as a general policy and then specific to sites.

Dr. SOOFER. Yes, sir.

Senator PETERS. I am also very concerned about the Russian deployment of an intermediate-range, nuclear-capable missile that is clearly in violation of the INF [Intermediate Nuclear Forces] Treaty. My question to you as well, Dr. Soofer, is, what concrete steps has the administration taken so far to react or to deal with this violation of the treaty? Do you believe that they are sufficient to deny Russia a military advantage that they gained from the deployment of these intermediate-range missiles?

Dr. SOOFER. Thank you, Senator.

The administration has concluded that the current situation is not sustainable. It is a violation, and we need to do something about it.

The National Security Council is reviewing steps to place more meaningful pressure on Moscow, both in terms of diplomatic and military measures to return them to compliance.

Meanwhile, the Department of Defense is reviewing military response options and framing this violation, this capability, again, in the context of the Nuclear Posture Review.

What does it mean? Why is Russia doing this? So, for instance, we know that Russia already has air-launch cruise missiles and sea-launch cruise missiles that can range similar targets in Europe. So the question is, why go forward? What is the military capability that Moscow derives from this? We come to the conclusion that there must be some military capability that outweighs the political repercussions of actually violating the INF Treaty.

So for Russia, this has a meaningful military capability, and we need to assess what that is and how to address it.

Senator PETERS. Well, so we should be expecting some concrete steps under what sort of timeline do you think?

Dr. SOOFER. Senator, I do not have a timeline for you, to be honest with you.

Senator PETERS. But do you think it is important to do it sooner rather than later?

Dr. SOOFER. I believe it is. Yes, sir.

Senator PETERS. It is a priority now, as far as being under review?

Dr. SOOFER. It is a priority. It is definitely a priority. The National Security Council, as I said, has already begun the process. They are well into the process, I should say.

Senator PETERS. Because I think it is important. I agree. It is my belief, too, that sooner is better.

Dr. SOOFER. Yes, sir.

Senator PETERS. We have concern with our allies now who are wondering where the United States posture will be, not just on nuclear deterrence but where we are on defense of Europe as well. Taking some concrete actions would be very important.

I guess that leads to my final point and my concern with how NATO allies, in particular, see the United States. Certainly, Secretary Mattis has been very clear, I think, in U.S. support of our NATO allies. He has also been very clear that we need to have strong allies, that you cannot be a power without having a lot of good friends around you as well.

That is why it was disturbing that President Trump did not reaffirm the U.S. commitment to article 5 of the NATO Treaty. In fact, the reports say he basically took it out of his statement when it was put in there, so he made a conscious effort not to mention that, which I think was unnerving to many people in Europe.

So, Dr. Soofer, last question, while I know you were not directly involved in any of that, but maybe you can comment. What role should the United States alliances play in our nuclear posture? Wouldn't you agree that it is just as important to reassure our allies as it is to deter our adversaries?

Dr. SOOFER. Absolutely, Senator. As I pointed out, the fundamental roles for nuclear weapons are to deter our adversaries and assure our allies. U.S. nuclear capabilities, dual-use capabilities in Europe, are a fundamental element of our extended deterrent that reassures our allies, and we will continue to do so. The Secretary of Defense has made that clear.

Senator PETERS. Thank you so much. I appreciate it.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator.

Senator Sullivan?

Senator SULLIVAN. Thank you, Madam Chair.

Gentlemen, thank you for your testimony here.

I just want to align myself with Senator Peters' comments on allies. I mean, we are an ally-rich Nation. Most of our adversaries and potential adversaries are ally-poor. It is probably the most important strategic advantage we have as a Nation, and we should be doing everything to deepen our alliances and expand them. I know a number of us have had discussions with General Mattis, Secretary Tillerson. So I know the Chairman of the Joint Chiefs feels that way.

So I couldn't agree more. We have to do more to support our allies and expand. We have great opportunities, great opportunities, to expand alliances in Asia, in the Middle East. I think it is something you see strong, strong bipartisan support on. I commend Senator Peters for his statement on that.

I also want to talk about missile defense.

Dr. Soofer, I am glad that you are there. I know your background. I know how much experience you have on the issue. You may have seen, 2 weeks ago, a number of us, including Senator Peters and I, introduced a comprehensive Advancing America's Missile Defense Act.

Before I want to ask a couple questions about some of the elements of that, can you give the committee here a sense of the increased threat that we are seeing right now with regard to North Korea? There has been plenty of open committee testimony, unclassified, saying it is no longer a matter of if but when North Korea is going to have the capability to have an intercontinental ballistic nuclear missile that can range not just Alaska and Hawaii but Detroit and New York and Chicago and L.A. [Los Angeles].

Give us a sense of how you are reviewing that threat. I know you cannot talk about timelines, but I think it is safe to say our intel community has consistently underestimated what they are doing, particularly with all his testing. Can any of you give us a sense just how real that is?

Dr. SOOFER. Senator, thank you.

I would just repeat what the intelligence community has said. North Korea is poised to conduct its first ICBM [Intercontinental Ballistic Missile] flight test in 2017. I think that——

Senator SULLIVAN. They have already launched a satellite, so they have the ability to fire an ICBM, essentially. Isn't that correct?

Dr. SOOFER. Exactly.

Senator SULLIVAN. So all they are missing is the reentry vehicle for a nuke, in terms of the capability?

Dr. SOOFER. Their most recent tests demonstrated a capability to—I think they have made further progress in their ability to develop reentry vehicles, in their last tests.

Senator SULLIVAN. That is another troubling development.

Dr. SOOFER. So, again, we are going to have to factor all this into the Ballistic Missile Defense Review. But in addition to what you

have seen in the open press, the classified information I think is even more dire. I mean, there is no question about it.

So the question for us, as we conduct a Ballistic Missile Defense Review is, what does it all mean? What can we do? What are the potential options for addressing the threat?

Senator SULLIVAN. Our goal is to make sure that, you know, the Members of the Senate who are on the bill that we introduced 2 weeks ago, is to make sure that, whoever is in the White House, has the kind of strategic time that, if and when he has this capability, we can announce to North Korea, look, you try to shoot one or two or three. You know, you want to go out in a blaze of glory? We will shoot that down. We have the 99 percent capability.

I know we do not want to get into numbers. Do we have the 99 percent capability right now to shoot down a rogue missile from North Korea? If you do not feel comfortable answering in this setting, you do not need to.

Dr. SOOFER. Senator, I think that we have a measure of protection today against the North Korean threat.

Senator SULLIVAN. But don't you think we can always enhance it, given that the threat is increased?

Dr. SOOFER. The pace of the threat is advancing faster than I think was considered when we did the first Ballistic Missile Defense Review back in 2010.

Senator SULLIVAN. So some of the key elements of the bill that we introduced are more GBIs [Ground-Based Interceptors], more advancing in terms of the acceleration of multiple kill vehicles on top of those GBIs, and an integrated, layered sensor system that would make sure that all of our different theater THAAD [Terminal High-Altitude Area Defense], theater Aegis, Homeland back here in America is integrated where we have an unblinking eye with regard to sensors, not only ground-based but in space.

Do you support those three pillars of how we are looking at missile defense, in your personal opinion? I know you are doing a review, but you are also someone who has a lot of knowledge on this issue.

Dr. SOOFER. Senator, I do support those, personally. I think it is based on an approach that was outlined by the previous administration. It enjoys support here in the Congress. I think it makes eminent sense.

So the only question now is, based on how we understand the projected threat, whether that is enough.

Senator SULLIVAN. As I am sure you are aware, we cut missile defense, the MDA [Missile Defense Agency] funding, by almost 50 percent since 2006. Do you think the current budget proposed by the President does enough to start to reverse that trend, again, given the threat levels?

Dr. SOOFER. Senator, I support the President's budget.

Senator SULLIVAN. Good answer. I am sure you had to answer it that way.

I do not think it does enough, so I think we need to do more.

Let me ask one final question, and it goes back to Senator Peters. As we are thinking about missile defense, we have THAAD. We have Aegis in the Asia-Pacific. The President talked about maybe a THAAD in Saudi Arabia.

Can you give us a sense—and, again, I know this is what Senator Peters asked, but I think it is a really important question. How do we start to incorporate thinking of protecting our Homeland?

The President talks about America first. I think we need America first on missile defense.

But protecting our Homeland in a way that integrates the usefulness and the knowledge we have from our allies, for example, the Israelis, as you know, in the NDAA every year, we have been very supportive of Iron Dome. But in some ways, they have technology and they have advanced in ways that could probably help us.

How do we need to look at integrating our alliances with protecting not only our allies but protecting our Homeland with our allies?

Dr. SOOFER. Senator, that is a key issue for the Ballistic Missile Defense Review. That is exactly what we are going to be looking at.

I think everything that you have proposed makes great sense. We have to do that. We also have to ask the question of whether the allies could do more, as well, on their own to provide protection.

So all of these factors will be weighed. I hope we can continue a dialogue on this as we move forward on the Ballistic Missile Defense Review to get your views and other Senators as well.

Senator SULLIVAN. Great. Thank you, and congratulations on your new position. I am glad you are in that position.

Dr. SOOFER. Thank you.

Senator SULLIVAN. Thank you.

Senator FISCHER. Thank you, Senator.

Senator Warren?

Senator WARREN. Thank you, Madam Chair.

Thank you to our witnesses for being here today. I want to ask some questions about the Nuclear Command, Control and Communication system, the NC3. I know it is actually 62 separate systems that involve everything from radios on the ground to systems operating on Air Force One. I also know that NC3 is critical to making sure that the President can communicate with commanders even if the United States is under nuclear attack.

So, obviously, security and resiliency are key components here.

So, General Rand, as the head of Air Force Global Strike Command, you are the one who is in charge on this. How would you describe the age and health of the NC3 system today?

General RAND. Ma'am, the system was allowed to atrophy or did atrophy over the last 25 years. There is no denying that. We have owned up to that, I think, as a Nation. The first thing you have to do is admit that. Then you have to identify—and, as you mentioned, there is actually 107 subsystems of which the Air Force maintains 62 of those, of which is 70 percent of the NC3 budget.

So the first thing we did is we started this journey a little over 2 years ago of, what is NC3? We have identified in a very thorough way the systems. Then we analyzed the health of each of those systems, and that is ongoing. Some of them are obsolete. They need to be replaced. Some need to be upgraded.

We are doing those things. But we did not get here overnight, and we will not fix NC3 overnight. But we are on a good path. So

I would tell you, where we are today—and, ironically, I just had what we call an NLCC [National Leadership Command Capability] NC3 Council that I chair with my fellow four-star major command commanders yesterday, and we are at least now able to identify and have a healthy discussion about what we need to do to fix some of these things. We would not have been able to do that 2 years ago.

There are good things on the horizon. We are about to close the deal on getting the presidential national voice capability, conferencing capability. Long overdue. We are getting very close to the family of beyond line of sight. It is called FAB–T [Family of Advanced Beyond Line-of-Sight Terminals] terminal, along with the force element terminal that will go on our bombers and tankers. That will give it an increased receive capability of getting messages, approaching anything to do with nuclear escalation.

These are some very meaningful things. We are standardizing across our command posts in our operations centers the ground-based terminals and radios for us to use. It is called Global Ascent.

So there are many things that we are moving out on and making improvements on. So we are in a far better place than we were. I will assure you this has the top-level attention in the Department of Defense.

Senator WARREN. Good. So when General Hyten says this is a top priority for me, you are all on board for that.

General RAND. Ma'am, I could not have told you what NC3 was 2 years ago. Now I dream about it.

Senator WARREN. Okay. The dreams are getting better, right?

General RAND. Periodically now, we brief AT&L [Acquisition, Technology, and Logistics] and the Vice Chairman, and those go directly to the Deputy SECDEF [Deputy Secretary of Defense] and SECDEF [Secretary of Defense]. This is a priority with the Office of Secretary of Defense.

Senator WARREN. Can I ask a question on that? Priority, I am very glad to hear this and hear the changes that you are making. I want to ask a slightly different question about urgency.

Given the age of the systems involved and how crucial they are to everything we do, do you have much margin for error in this process?

General RAND. Ma'am, I would tell you that we use the term "just in time." I will tell you, it should be called "late to need."

Senator WARREN. Yes.

General RAND. In the nuclear enterprise, this is one element of it that we have allowed things to get to the point where we do not have the margin of error.

Senator WARREN. Okay. All right.

General RAND. That is why I am here. That is why this modernization effort is so important, because any SLEP we have had has been eroded.

Senator WARREN. It is at least helpful to know, as you say. If we do not know it, we cannot change it. You have to come to us and let us know how we can be helpful.

I want to ask a question from a little different angle, too. You are the primary customer for NC3. You set the requirements. I know you are staffed up now to do this. But Air Force Materiel

Command is responsible for actually acquiring the systems to meet your requirements.

So when General Hyten was here recently, he said that he was concerned about staffing gaps on the acquisition side of the NC3 program.

General RAND. Yes, ma'am.

Senator WARREN. So let me ask you, General Rand, what is the Air Force doing in this budget to address the acquisition challenges associated with NC3?

General RAND. Thank you for that. I am in very close cahoots with my dear friend Ellen Pawlikowski, who is the Commander of Air Force Materiel Command.

Yesterday, at our council meeting, two issues came up, the funding for the FAB–T FET it is called, that Force Element Terminal, and for the programs that we have, many of the programs, is to make sure that we have the people who can manage those programs from cradle to grave. We are going to the Air Force to discuss now how we can get the manning where those gaps exist.

But we have come a long way, again, in the last year. Now the civilian hiring freeze slowed us down a little bit, but we have reprieve from that. I have been able to bring in an additional 235 people to Air Force Global Strike.

Senator WARREN. Two hundred thirty-five.

General RAND. Yes, ma'am. We stood up, 1 April, we stood up the NC3 center at Air Force Global Strike and Ellen, we are working—and for the first time, we have in NC3 program manager at Hanscom Air Force Base in Boston. We have identified what she needs.

We need to do a full court press to try to get an additional 50 to 60 people to help with the nuke weapons center and the NC3 portfolio. There are a variety of programs that we need to man up, and we are going to do it.

Senator WARREN. Good. I appreciate the work that you are doing.

I am out of time now, but I am going to send some questions for the record to Mr. MacStravic just about your role in helping out on this.

I am glad you are making this a real priority, and I understand the urgency. If we can be helpful, I hope you will let us know.

General RAND. Thank you very much.

Senator WARREN. It is important.

General RAND. I appreciate your support.

Senator WARREN. Thank you. You bet. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you.

Senator Cotton?

Senator COTTON. Thank you, gentlemen. Thank you for your testimony today.

General Rand, in Congress, we often talk about ballistic missile defenses from the threats we face of rogue nations like North Korea, for instance, but our adversaries are not sleeping on this potential technology. They, too, would like to develop ballistic missile defenses. How can we ensure that our reentry vehicle system remains survivable against any emerging threats by our adversaries?

General RAND. Sir, we need to develop emerging technologies. That is why I am a huge proponent for GBSD.

Before you came in, I had mentioned that there are two aspects to deterrence: reliability, which we own, and the weapon survivability, which the enemy gets a vote in. We need to do some things that we will not be able to do with existing systems to ensure that the weapon will get to its intended target with the intended effect that we have.

That is the essence of why we need GBSD. So what we need to do is to pursue this acquisition strategy and stay true to course and field this capability by the time we need, which is 2030. Because that is when I see this big closure of the technology gap that we have had the benefit of having for many decades that is getting smaller and smaller. If we do not do something, that gap will close.

Senator COTTON. You say there are things we need to do, and we need to complete this acquisition strategy. Could you be more specific about that?

General RAND. Yes, sir. We are on track. Right now, we are going to down select to two companies to go for GBSD this summer to go into the TMRR, the Technological Maturity Risk Reduction. This is the process.

In 3 years, then we will down select to the company. We are on track with the strategy.

Any specifics, if I may, sir, to talk about what those emerging technologies are, I would like to take into a closed session about what we would need to the guidance system, to the warhead, et cetera.

Senator COTTON. So the specifics that would ensure our reentry vehicles are survivable in the GBSD world as compared to today's world you would like to discuss in a classified setting.

General RAND. I would need to do that, yes, sir.

Senator COTTON. I understand.

Since we are on GBSD, though, I understand that one option under consideration is moving operations into an integrated command center, so you just have one building on base that host missile crews, maintainers, and security forces. That would mean instead of having 15 crews on alert in a missile field, you would have 6, 7, or 8 on alert.

This concept is a direct result of the RFP [Request for Proposal] mandating a reduction in operations and sustainment costs. No doubt, the missiliers would appreciate not having the 2-hour drive out to launch control centers. I know that we have to look for places to trim costs in this budgetary environment.

But the large number of command centers and launch facilities in the three missile fields are, in fact, a real irritant to enemy planners. I am concerned that this setup might give adversaries one target instead of multiple targets, freeing up some of their forces to strike other militarily significant targets or even target American cities.

So could you please elaborate on how you can reduce on-alert missile field crews without reducing missile field resiliency?

General RAND. Yes, sir. I think that is a fair question. I think that these would be moderate improvements, and that would not take away from complicating the enemies' targeting. There would

still be a lot of launch facilities they would have to be accountable for, and I think that we would still give them a targeting problem.

We are mandated by the New START [New Strategic Arms Reduction Treaty] Treaty right now. I am happy to report that we have completed that. We still have 450 launch facilities that the enemy has to be accounted for.

Senator COTTON. Thank you.

Dr. Soofer, congratulations on your new position.

Dr. SOOFER. Thank you.

Senator COTTON. Our committee's loss is the country's gain.

I would like to talk briefly about satellite doctrine. Decades ago, we had satellites that were, oftentimes, single-mission satellites. There was an understanding that, if a sensor was nuclear-designated, that the United States might take it as a precursor to a nuclear strike, if there was any effort to impair or destroy that satellite.

Obviously, one trend in space today is multi-mission platforms. How would that trend in satellite technology affect our doctrine as it relates to any effort to disable or destroy American satellites?

Dr. SOOFER. Sir, space is actually not in my portfolio.

Senator COTTON. But you are very smart on nuclear doctrine, and I think nuclear doctrine is.

Dr. SOOFER. One of the key things we will be looking at in the Nuclear Posture Review is potential vulnerabilities to the U.S. nuclear deterrent. So we will be examining that very issue.

So if the adversary can blind our indications and warning to an attack, that is a big deal. One way they would do that, of course, is through satellites. If our satellites are vulnerable, we have to figure out some way to compensate for that.

Deaggregating, spreading assets around, makes a lot of sense. There are other ways of doing it. I remember many years ago, we had a concept called Operationally Responsive Space, where we had small satellites in the barn that, if our main satellites were taken out, we could immediately launch new capabilities.

So I think all of these points will be addressed as part of a broader National Defense Strategy. But the key point about vulnerability of indications and warning will be something that we will look at carefully in the Nuclear Posture Review.

Senator COTTON. I think as part of that review, you do need to consider the doctrinal implications. In a world in which a satellite sensor is nuclear-only, it is only designed to detect nuclear launches of our adversaries, it is a reasonable understanding for a nation-state to say a strike on that satellite will be treated as an early warning of a first strike against our territory.

If, in an evolving space environment, satellites carry not only nuclear sensors but say GPS [Global Positioning System] positioning packages or communication packages, our adversaries might rightly say you can no longer treat that as an early indicator of a nuclear strike, if we are going to be in a conventional environment and treat that as a communications or GPS positioning package. It is just something that I think we need clarity on, as space technology has evolved.

Thank you.

Senator FISCHER. Thank you, Senator Cotton.

Senator Heinrich?

Senator HEINRICH. I will just start, for the record, and mention that ORS [Operationally Responsive Space] is doing quite well. I think, this year, their budget actually reflects the direction and trend that we have all seen coming for quite some time, and I am excited about that progress.

I want to start with General Rand and Admiral BENEDICT.

Like Senator Donnelly, I continue to be very interested in the ensured supply of domestic, trusted microelectronics. The Air Force and the Navy are pursuing separate refurbishments of fusing systems for the W88 and the W87, which includes partnering with Sandia National Labs. Sandia's portion of the work for Navy and Air Force includes designing, qualifying, and manufacturing critical strategic radiation-hard microsystems for both of those, the 88 and the 87.

How important is strategic radiation-hard capability to the U.S. deterrent, and to both the Air Force and the Navy, consequently?

Admiral BENEDICT. So in the program that we refer to as the Alt 370, which is the new arming, fusing, and firing circuit for the W88, we were directed, the Navy and the Air Force, to work that program jointly. The Navy has the lead in support of that effort.

That has proven to be, I would say, the example, I think, when General Rand and I talk about commonality and interservice support. I think the Alt 370, that fuse effort, is this sort of model that I look to.

We have made accommodations within our reentry body, as has the Air Force, in order to develop sort of a tiered approach. So there are components within that device that are absolutely common and will be utilized exactly in the Air Force program. There are components in there that are adaptable based on the fact that our reentry body flies on a Trident. Their reentry body will fly on a Minuteman or a GBSD. Then there are unique based on the two missiles.

In doing so, we were able to, I would say, assist the Air Force in cost-avoiding a significant amount of money. What it did is it allowed both services as well as Sandia to optimize the talent pools and grow those over time.

So I applaud and I am 100 percent on board. That program is on schedule for a December 19 IFI in the United States Navy, and all the work has been transferred to the Air Force in support of their fuse program, sir.

Senator HEINRICH. Given that the MESA [Microsystems and Engineering Sciences Applications] facility there at Sandia is soon going to reach the end of its service life, what are your thoughts on how to make sure we maintain that niche capability of both research and production of rad-hard trusted electronics?

Admiral BENEDICT. Yes, sir. I believe that within the Navy and the Air Force, there are four unique, specific technologies that, if the United States Navy or the United States Air Force is not in design, development, or production, then industry, in and of themselves, will be incapable or have no economic incentive to sustain, one of them being solid rocket motors at the strategic grade, at both the Navy and the Air Force. The other one is radiation-hardened electronics to the levels that we need, which are far above sun

radiation. The other one is reentry body materials, and the specific unique aspects of those. Then the fourth one is our guidance requirements for both ICBMs and SLBMs [Submarine-Launched Ballistic Missiles].

So I can remember back to the day when there were congressionally mandated technology application programs, which ran at a certain level. They were generated, directed by Congress, so that the Navy and the Air Force could sustain those capabilities as well as grow the personnel talent in order to implement in the future.

Over time, those have basically waned to zero. So I think those are absolutely necessary attributes. Today, what we are doing is working collaboratively, the Navy and the Air Force, to try to, through commonality, share some of those requirements.

But they are on the edge of extinction. If we find ourselves in a period, as we do now, the Navy coming out of D5 LE [life extension], a period of time before GBSD ramps up, the Nation, not the Navy or the Air Force, but the Nation, I believe, is at risk.

Senator HEINRICH. General?

General RAND. I do not have anything to add. I agree with Admiral Benedict completely on that.

Senator HEINRICH. It sounds like we need a MESA 2.0.

But moving to another related issue, General Rand, I wanted to ask you, it is my understanding that, last year, Kirtland Air Force Base actually became a Global Strike Command base.

How is that transition going? What are you doing to integrate the base into your command?

General RAND. Yes, sir. Thank you.

Senator HEINRICH. Bring us up to speed on that, if you could.

General RAND. Really, really proud to have Kirtland in the command. It made all the sense in the world. I would tell you the transition is over. It was very seamless.

Senator HEINRICH. Great.

General RAND. It was a snap the chalk line, and we did it. Eric Froehlich and his wife just got the O'Malley Award for the best wing commander and spouse in the Air Force. Great leadership matters.

But it made sense, if I may, because if Air Force Global Strike is designated the lead command for all things nuclear in the United States Air Force, there is so much at Kirtland. It made all the sense in the world to include the Underground Munitions Maintenance and Storage Complex, Sandia labs, the Nuclear Weapons Center, the Safety Center, all the things that we do.

So this has just been an outstanding opportunity for us to kind of share best practices on all the things that we do.

Senator HEINRICH. Great. I am glad to hear that.

Assistant Secretary Soofer and General Rand, for that matter, New START is set to expire in 2021. What are we doing to prepare for that? Is the U.S. seeking to extend the treaty? If either the Russians or the United States decided to pull out of it, what would be the consequences for strategic stability? What would we potentially lose in terms of defense and intelligence benefits?

General RAND. If I may, first, and then I will defer to Dr. Soofer to give the policy part, for me, it was the compliance piece. I am

happy to report that we are in compliance with what we were required to do with our bombers and our ICBMs.

As of 2 June, we are 3 months ahead of STRATCOM's [Strategic Command] request date. It was February 2018, I think, that we had to meet the New START, and we are complete. So compliance, the United States Air Force is in full compliance with New START.

I will defer to you.

Dr. SOOFER. Admiral Benedict, why don't you——

Admiral BENEDICT. Sir, if I may, we have completed our conversion on the New START Treaty on 13 of the 14 boats. The remaining boat will be done next month. It has departed the shipyard, so it just has been one of access. So we will complete next month, well in advance of General Rand's acknowledgment of the February 2018 requirement.

Senator HEINRICH. Great.

Dr. Soofer?

Dr. SOOFER. Senator, I believe the Secretary of Defense has confirmed the importance of the New START Treaty. The National Security Council is conducting a review of our arms control policies and our treaties, and they will take into account New START as well. We are looking at the INF Treaty, so that will all be weighed in.

But in terms of how we assess the New START Treaty, this is the way I look at it. It is not so much what is in treaty but what is not in the treaty that may present the problem that we are going to look at in the Nuclear Posture Review.

So the New START Treaty did not address a whole host of nonstrategic nuclear weapons, and it is those categories of weapons that are on the rise. So we have to understand what the implications are of that for nuclear posture.

So I would just say that there is a broader issue than just whether or not to stay within the New START Treaty. Even if you stay in the New START Treaty, there may be strategic implications.

Senator FISCHER. Thank you, Senator.

We do have some time, so I would like to do second round. Let's set it at a 4-minute round, please.

General Rand, in your prepared testimony, you state that lessons learned from the difficulty sustaining and modernizing that B–2 small fleet should be considered when determining the purchase size of future acquisitions such as the B–21.

Could you elaborate on that, please?

General RAND. Yes, ma'am. I mean, obviously, the first thing is to meet combatant commander requirements. So the reason that I have established what I consider to be a minimum of 100 B–21s has everything to do with being able to meet the requirements that the combatant commanders have established for us.

But we have to learn from the painful experience of the B–2. That program was going to be well over 100. It got slimmed down, and it eventually ended up at 21. It became very expensive, and now, as we find, very difficult to maintain a small fleet. As it is now 25 years old, and there are so few of them, we are having trouble with subcontractors, parts, the supply chain.

These are just things that you do not have to deal with when you have a larger fleet. But, again, the size of the fleet is not going to be based just on that. It is really to meet requirements.

Senator FISCHER. But it is a good lesson.

General RAND. It is a very good lesson.

So two things would happen, ma'am. If we did not get the minimum of 100, I would not be meeting critical combatant commander requirements, and it would be another nightmare to maintain. We would have to keep other bomber fleets that I think have lost their utility longer than what they are intended for.

Senator FISCHER. Thank you, sir.

Admiral Benedict, can you talk about the proposal to relocate operations that are currently performed at the Naval Industrial Reserve Ordnance Plant to Colorado and Florida, and specifically the cost savings that this would achieve?

Admiral BENEDICT. Yes, ma'am.

You are referring to Lockheed's decision and our support of that decision to move the Fleet Ballistic Missile Program out of Sunnyvale, California, and relocate approximately 650 individuals to their Lockheed facility in Denver, Colorado, and down to the Space Coast of Florida. We fully support that and endorse that effort by Lockheed Martin.

What that will entail is about 300 design engineers moving from Sunnyvale, California, to Denver, and about 350 individuals that do operational support in the program office moving down to the Space Coast of Florida.

We currently have about 700 Lockheed Martin employees in the Space Coast. So our footprint for Lockheed Martin, which is my prime missile contractor in Florida, will be well over 1,000 individuals.

If you go to Sunnyvale, California, where Lockheed is, at one time, it was a sprawling campus. It is now literally a much smaller campus surrounded by Google, Facebook, Yahoo, Juniper. You can go on and on and on, and the ability to attract talent at a rate that I can afford, both I and Lockheed recognized, was not a sustainable program until 2084.

So I applaud completely the decision by Lockheed to take this time and invest the amount of analysis that they have done in order to make the move at this point in the program before we start back up with a potential follow-on missile to the Trident II D5. So we are fully on board, ma'am.

Senator FISCHER. Thank you.

You and I have had discussions about the *Columbia*-class submarine and the production schedule that we are looking at there, that there really is no margin for delays in that schedule if we are going to have them on watch in 2031. That is only 14 years from now. This is DOD's second-largest acquisition program, so I certainly hope nothing goes wrong as we are moving forward.

As we look at the history, though, when it comes to acquisition at DOD, sometimes that would suggest that contingency planning is a must. So can you discuss what steps, if any, are being taken to mitigate potential delays in that *Columbia*-class program?

Admiral BENEDICT. Yes, ma'am.

We have spent an appropriate amount of time under close scrutiny of Mr. Stackley when he was the Assistant Secretary of the Navy, and he remains personally and professionally invested in this program as the Acting Secretary.

Throughout the development of the program, we took steps to mitigate risk. I will give you a couple, at least on my side—the strategic weapons system.

We authorized the development and formulation of what we call the Strategic Weapons Systems Ashore facility down in Space Coast Florida at the Naval Ordnance Test Unit. That facility is up, and half of this facility is certified. The other half is on track to be certified.

What that will allow us to do is prove all the shipyard-integrated test programs, which will expedite the acceptance of the platforms as they move through not only Electric Boat but also the U.K. [United Kingdom] shipyard over in Barrow-in-Furness in the United Kingdom.

So that is a major risk reduction. The other major risk reduction is the facility that we built at China Lake, California, at the Naval Air Warfare Center. That is where we will certify the ability to get back into production of our launch tubes.

We have been out of production of launch tubes for about 25 years. Many, many of the materials have changed. Our glues, our adhesives, the materials that are absolutely paramount to a successful launch underwater, which you had the opportunity to witness, of a missile the size of a Trident. So we will use that facility to certify the design. Then we will go into production there.

On the shipboard side, Naval Reactors has their own program that they are operating out of Philadelphia, Pennsylvania, to ensure that their components are tested well in advance and certified to move toward the platform itself.

Then with Electric Boat, in concert with the United Kingdom, we have a first article test program where we will build early and jointly to ensure that the design is valid and that the design can be produced not only on schedule but, most importantly, on cost as we move forward.

So all these things are moving in parallel, and then they all converge starting in, essentially, 2021, so that we can put the boat in the water in 2028, and be on patrol in 2031.

Yes, ma'am.

Senator FISCHER. Thank you, sir.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

Dr. Soofer, when we look at the cost of our nuclear deterrent as a percentage of the defense budget, what is the cost of our nuclear forces now versus the cost during the peak years of the modernization effort?

Dr. SOOFER. Thank you, Senator.

Actually, I have a chart here, if we could hand them out. This is a chart that may look familiar to you. We have used it in the past in the committee.

[The information referred to follows:]

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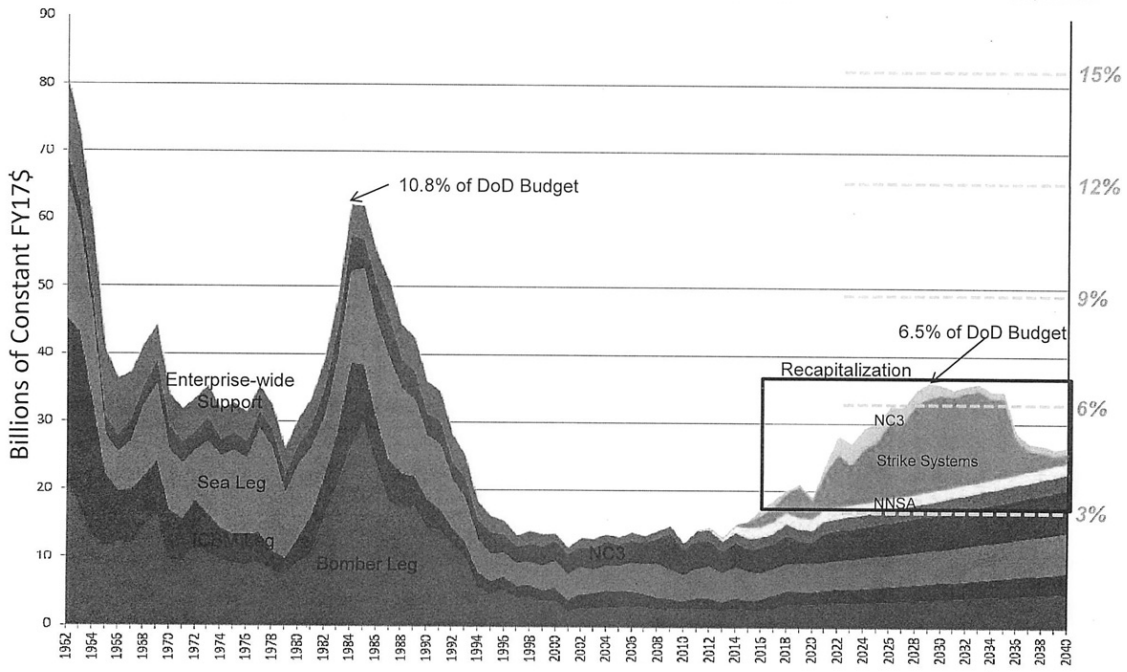
History of Nuclear Enterprise Funding

Sustainment and Recapitalization

OSD



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If you look at the box in the lower right-hand corner, this is all the new stuff that we need to buy, the triad, the nuclear command and control.

If you look at the peak there, it is about 6.5 percent of the defense budget. If we did not do the recapitalization, we would still be spending about 3 percent.

So today, we spend about 3 percent of the defense budget on all of our nuclear enterprise. That is to operate it, to sustain it, and to maintain it. The additional increment for the modernization, the recapitalization, would be probably another 3 percent, 3.5 percent.

Senator DONNELLY. Okay.

Another question I wanted to ask you about, obviously, this situation with North Korea is difficult. It is tense.

Dr. Soofer, what are your thoughts on how to best reassure our allies in South Korea while effectively deterring North Korea, especially given the increasing sophistication of the program?

Dr. SOOFER. Thank you, Senator. It is a multifaceted approach.

So the Secretary of Defense visiting South Korea is one way of assuring them. We have bombers that overfly South Korea to send a message. We take their senior military officials to visit certain U.S. nuclear capabilities. We hold dialogues with their military and with their Ministry of Foreign Affairs twice a year, once in their country and once in the United States, to talk about U.S. nuclear strategy, to try to explain some of our capabilities.

So it is a combination of the messaging and the actual capabilities that we show them that hopefully reassures them.

Senator DONNELLY. My last question is, Admiral Benedict, I was wondering, what are the main risks that you are concerned about with the construction of the launch tubes for the *Columbia*-class? I know you talked a little bit about changing materials from before and all these kinds of things. What are the things that keep you concerned?

Admiral BENEDICT. I think, first and foremost, is the fact that we have been out of production of launch tubes for approximately 25 years. It is a fairly significant production run. It is 240 launch tubes for both the U.S. and the United Kingdom.

Obviously, a lot has changed in those 25 years, specifically the environmental aspects that we are now required within the United States and specifically in the State of California. We produce our launch tubes in Sunnyvale, California, at Northrop Grumman.

So as we do that, the original design called for some very unique adhesives, glues, materials, which if we could find them, which we can't, we would probably have a hard time incorporating them into the current design. So we have had to replicate or, in many cases, supplement different materials.

Again, as you had the opportunity to ride the boat and watch the launch of a Trident, it is a very simplistic looking launch tube, but it is a very complicated design to keep that pressure underneath that missile as we eject it in a steam bubble. That whole launch tube has to sustain that shock and that impulse while the missile travels through it.

So that is what keeps me up. Then, of course, the other thing is the work force. There is no work force that built the last launch tube. We have to create a work force.

Senator DONNELLY. Let me ask you one more.

Admiral BENEDICT. Yes, sir.

Senator DONNELLY. That would be, have you reviewed any other locations within the Navy inventory to host all or some of the Sunnyvale jobs?

Admiral BENEDICT. We have. Again, part of our acquisition strategy is that we hold the prime accountable to make the most economic decision. We are appropriately facilitized within Northrop Grumman in Sunnyvale, California, which is where we built every launch tube, in terms of tooling and facilities, to start that production line there.

Just as we made the decision to move out of Sunnyvale, California, with Lockheed Martin, I have raised that same question with every one of my industrial partners thinking long-term toward 2084.

Senator DONNELLY. For Lockheed Martin, too?

Admiral BENEDICT. Yes, sir.

So I would say that Northrop has made the decision that, given the infrastructure and the investment that they have there, that is the most economic place to produce this run. But I know that they are looking at options after the production run would end on where they should locate.

Senator DONNELLY. Has Lockheed looked at other options than the Space Coast and Colorado?

Admiral BENEDICT. Well, Lockheed looked at those and made that decision, so Lockheed FBM [Fleet Ballistic Missile] is out of Sunnyvale. Now, there remains THAAD and other programs. Satellite programs will remain in Sunnyvale.

The only program moving completely out of Sunnyvale, California, for Lockheed Martin is the Fleet Ballistic Missile Program. Northrop also produces a significant amount of material for PEO Submarines and Naval Reactors. So turbines and gears, all that material is produced in the same factory that I produce the launch tubes.

So there is a sufficient throughput through that factory to justify the launch tube production in that facility.

Senator DONNELLY. Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator Donnelly.

I am going to ask another question, if you want to follow up again, too, then.

We are having a lot of fun here today. So thank you.

General Rand, I just want to point out something in your written testimony that you said. "I cannot overemphasize this point: B–21 and B–52 without LRSO [Long-Range Standoff Missile] greatly reduces our ability to hold adversaries at risk, increases risk to our aircraft and aircrew, and negatively impacts our ability to execute the mission."

Would you like to comment on that?

General RAND. Ma'am, I do not know how I can make it any clearer. I stand by those words.

Senator FISCHER. You would be supportive of us moving forward on that, correct?

General RAND. Absolutely.

Senator FISCHER. Thank you, sir.

General RAND. Again, the only comment—to me, it is just critical and fundamental that we have long-range standoff, with or without a B–21.

The current long-range standoff nuclear weapon we have, the ALCM, Air Launch Cruise Missile, is 37 years old today. It will hit 40 by 2020. By the time we replace it in 2030, it will be a 50-year-old weapons system.

For the same reason I talked to Senator Cotton about the importance of being able to replace GBSD, if we want the weapon to hit its intended target, we have to modernize it.

Senator FISCHER. Thank you, sir.

Senator Donnelly, do you have anything to add?

Senator DONNELLY. I just want to thank the witnesses for being here today. Thank you.

Senator FISCHER. I would thank you all for being here today. We always appreciate the information that you provide to us.

If you do receive written questions from any members, I would ask that you answer those and return them promptly.

Senator FISCHER. Thank you again for your attendance.

We are adjourned.

[Whereupon, at 3:54 p.m., the subcommittee was adjourned.]

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR JOE DONNELLY

B–52 LIFE EXTENSION

1. Senator DONNELLY. General Rand, my understanding is the B–52 electronics warfare suite is 1980's technology, have you considered upgrading it since it still must come into firing range for any standoff weapon and our adversaries are increasingly using advanced strike systems?

General RAND. The B–52 defensive systems are optimized against 1970s era threat systems and place the B–52 at risk while accomplishing current OPLAN taskings. Air Force Global Strike Command is currently conducting studies to determine an affordable path for the Electronic Warfare modernization efforts the B–52 requires to remain relevant in the modern battlespace.

2. Senator DONNELLY. General Rand, how serious is the shortfall with the survivable communications for the B–52 whether it is MILSTAR or its Very Long Frequency system? What actions are being taken to maintain or upgrade these systems?

General RAND. [Deleted.]

"3+2" WARHEAD LIFE EXTENSION

3. Senator DONNELLY. Mr. MacStravic, is the Nuclear Weapons Council (NWC) "3+2 Strategy" still considered to be viable? Will the NWC re-evaluate 3+2 and other approaches to stockpile sustainment following the Nuclear Posture Review (NPR)? Should 3+2 Strategy be placed on hold pending the NPR?

Mr. MACSTRAVIC. The Nuclear Weapons Council's (NWC) long-term strategy for the nuclear weapons stockpile is the 3+2 Strategy, with three types of interoperable nuclear explosive packages for use in submarine-launched and intercontinental ballistic missiles, and two types of air-delivered warheads. It is premature to prejudge any outcome of the Nuclear Posture Review (NPR). The 3+2 Strategy should not be placed on hold pending completion of the NPR. The Department of Defense (DoD) strongly supports full funding for the Department of Energy's (DOE) nuclear weapons programs. The NPR will examine all elements of U.S. nuclear forces and posture to ensure that our nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st Century threats. The NWC will carefully consider the results of the NPR, and the DoD and DOE will work closely with Congress should any changes to the current program of record be recommended.

ASSISTANT SECRETARY OF DEFENSE FOR NUCLEAR, CHEMICAL AND BIOLOGICAL DEFENSE PROGRAMS, ASD (NCB)

4. Senator DONNELLY. Mr. MacStravic, the upcoming modernization bow wave will rely heavily on the roles of the ASD (NCB) and the Nuclear Weapons Council in particular.

As you re-organize the Department's acquisition arm are you ensuring the Assistant Secretary of Defense for Nuclear, Chemical and Biological Weapons is intact and can perform its duties?

Mr. MACSTRAVIC. The Secretary of Defense and the Deputy Secretary of Defense are executing the required re-organization of the Office of the Under Secretary of defense for Acquisition, Technology and Logistics. We are committed to ensuring that future nuclear modernization efforts are fully supported and appropriately managed.

QUESTIONS SUBMITTED BY SENATOR ELIZABETH WARREN

OVERSIGHT OF NC3 ACQUISITION

5. Senator WARREN. Mr. MacStravic, the Nuclear Command, Control, and Communication system (NC3) is critical to ensuring communication if the United States is under a nuclear attack, but it requires significant modernization. General Rand testified that there is little to no slack in the acquisition schedule, and said that the Air Force was coordinating with AT&L. What is the role of AT&L in ensuring that this program stays on schedule as the existing NC3 system wears out?

Mr. MACSTRAVIC. USD(AT&L) co-chairs the congressionally-mandated Council on Oversight of the National Leadership C3 System (Council). The Council is responsible for oversight of, advocacy for, and prioritization of resources for NC3. The NC3 system is a complex system-of-systems that demands synchronization of many programs and projects to deliver modernized capabilities as quickly as possible, while continuing to satisfy current needs. The Council, and by extension the USD(AT&L) monitors the status of the existing system, the modernization efforts, and the NC3 end-to-end interface modernization. In addition, by law the Council must notify congressional defense committees if an authorization or appropriations bill provides insufficient funds for NC3 modernization. USD(AT&L) also chairs the Defense Acquisition Board and is the Milestone Decision Authority (MDA) for selected NC3 modernization programs. As the Defense Acquisition Executive, USD(AT&L) oversees the performance of the Defense Acquisition System. In these roles, USD(AT&L) ensures that programs, including NC3 modernization programs, stay on schedule. Since the Air Force is responsible for approximately 75 percent of the NC3 budget, this often means coordinating with the Air Force Service Acquisition Executive, Program Executive Officers, and Program Managers to address issues that affect their programs.

6. Senator WARREN. General Rand, you testified that General Pawlikowski, Commander of Air Force Materiel Command, requires additional billets in the NC3 program executive office in order to ensure the NC3 acquisition stays on schedule. Given the priority placed on the NC3 program, how and when does the Air Force intend to resource those billets?

General RAND. As the Air Force Lead for Nuclear Command, Control and Communication (NC3), Air Force Global Strike Command will support all valid requirements to ensure the NC3 program executive office is properly sourced to ensure acquisitions stay on schedule. To that end, any validated need put forth by General Pawlikowski or any of our mission partners during the Fiscal Year 2019 Program Objective Memorandum (POM) or any subsequent POM submissions, I will personally advocate for ensuring it remains a high priority to the Air Force corporate structure.

7. Senator WARREN. General Rand, you testified that the Air Force completed a comprehensive review of each NC3 sub-system to assess its health and prioritize modernization efforts. Please provide the results of that review to the committee.

General RAND. Air Force Global Strike Command has taken action on many fronts to maintain in integrated, synchronized and responsive operational capability across the Air Force Nuclear Enterprise, including Nuclear Command, Control and Communications (NC3). The Secretary and Chief of Staff of the Air Force signed a memo in August of 2015 designating Global Strike Command as lead command for Air Force National Leadership Command Capability (NLCC)/NC3. The memo also established a Program Executive Officer for Air Force-owned portions of NC3 and di-

rectly-related elements of NLCC. This memo also drove the Air Force to establish the Aif Force NC3 Center, a brick and mortar facility at Barksdale Air Force Base housing 236 NC3 professionals focused organize, train and equip matters for NC3 in support of U.S. Strategic Command. This same memo also designated NC3 systems as a weapon system with the Air Force Nuclear Weapons Center as NC3 material manager. Following these designations, Air Force Material Command Commander formally tasked Air Force Nuclear Weapons Center Commander to provide direct support to Global Strike Command and directed a three phased NC3 Health Assessment to begin the process of normalizing the Air Force NC3 Weapon System. The results of this assessment has been the foundation for many changes and reforms to the NC3 enterprise. The 2015 Health Assessment used a systems level approach to determine the overall status of the NC3 Weapons System. It looked across the enterprise and reported well over 600 actionable items binned into five categories. Operational and Maintenance Reporting of specific system health, Formal NC3 Training, Manning across the NC3 enterprise, Electromagnetic Pulse Protection and Technical Order deficiencies. Many of these 600 assessment action items have been resolved or have become obsolete based on the NC3 Weapon System developments over the past three years. Global Strike Command continues to take action on findings of the report, some of which will take time to fix. Overall, Global Strike Command and its NC3 Center use the results of the health assessment to guide actions for improvements in policy, planning, programming, and sustainment areas as applicable to the NC3 Weapon System.

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