S. HRG. 115–674, PT. 7

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2019 AND THE FUTURE YEARS DEFENSE PROGRAM

HEARING

BEFORE THE

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

ONE HUNDRED FIFTEENTH CONGRESS

SECOND SESSION

ON

S. 2987

TO AUTHORIZE APPROPRIATIONS FOR FISCAL YEAR 2019 FOR MILITARY ACTIVITIES OF THE DEPARTMENT OF DEFENSE AND FOR MILITARY CONSTRUCTION, TO PRESCRIBE MILITARY PERSONNEL STRENGTHS FOR SUCH FISCAL YEAR, AND FOR OTHER PURPOSES

PART 7
STRATEGIC FORCES

MARCH 14, 22; APRIL 11, 2018

Printed for the use of the Committee on Armed Services

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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2019 AND THE FUTURE YEARS DEFENSE PROGRAM

WEDNESDAY, MARCH 14, 2018

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

DEPARTMENT OF ENERGY ATOMIC ENERGY DEFENSE ACTIVITIES AND PROGRAMS

The subcommittee met, pursuant to notice, at 2:30 p.m. in Room SR–232A, Russell Senate Office Building, Senator Deb Fischer (chairman of the subcommittee) presiding.

Subcommittee members present: Senators Fischer, Cotton, Donnelly, Reed, Warren, and Peters.

OPENING STATEMENT OF SENATOR DEB FISCHER

Senator FISCHER. The hearing will come to order.

The subcommittee meets today to receive testimony on the Department of Energy's atomic energy defense activities.

Thank you to the witnesses for appearing before us today and for your service to this country. We appreciate it.

We are very pleased today to be joined by the ranking member of the full committee, Senator Reed from Rhode Island, and I would ask Senator Reed if he has comments to make at this time.

Senator REED. I do not have an opening statement. Thank you, Madam Chairman.

Senator FISCHER. Thank you.

Today's hearing marks the subcommittee's first meeting in open session since the release of the administration's 2018 Nuclear Posture Review, which makes several key points that will be relevant to our discussion today. Where the NPR [Nuclear Posture Review] affirms the need for a modern and responsive nuclear infrastructure, it acknowledges that this has been a goal of all previous NPRs and that we have failed to make sufficient progress towards achieving this objective.

As a result, it clearly states that there is no margin for further delay, a point you echoed in your prepared testimony, Secretary Gordon-Hagerty, and that, "Significant and sustained investments will be required over the coming decade to ensure that NNSA [National Nuclear Security Administration] will be able to deliver the

nuclear weapons at the needed rate to support nuclear deterrence in the 2030s and beyond."

Secretary, we look forward to hearing from you about the steps NNSA will be taking to confront this challenge and how the fiscal year 2019 budget request supports your needs with respect to sustaining the current stockpile and fulfilling NNSA's other missions.

I also appreciated our discussion on Tuesday and your view that we must make a decision on the plutonium strategy and proceed aggressively so that we can meet the requirement to produce 80 pits per year by 2030. This committee looks forward to the conclusion of NNSA's engineering analysis and working with you to address this critical issue.

Mr. Owendoff, we look forward to hearing an update from you on the Department of Energy's environmental management portfolio and Mr. Trimble's assessment of EM's [Office of Environmental Management] efforts.

And, Admiral Caldwell, as always it is good to see you again and hear about Naval Reactors' contribution to our national security.

With that, our ranking member has not arrived yet. I will ask for his opening statement when he does come, but I would like to begin with the Secretary, if you have an opening statement.

STATEMENT OF HONORABLE LISA E. GORDON–HAGERTY, UNDER SECRETARY FOR NUCLEAR SECURITY, DEPARTMENT OF ENERGY

Secretary GORDON-HAGERTY. Thank you very much, Chairman Fischer, Senator Reed, and the distinguished soon-to-join-us members of the subcommittee. Thank you for the opportunity to present the President's fiscal year 2019 budget request for the Department of Energy's National Nuclear Security Administration.

I would also like to thank you both for your support during my recent confirmation. It is a privilege to sit here before you today representing the extraordinary men and women of the DOE [Deparment of Energy] NNSA and the vital roles we play in executing our Nation's nuclear security mission.

Chairman Fischer, a written statement has been provided to the subcommittee, and I respectfully request that it be submitted for the record.

Senator FISCHER. Without objection.

Secretary GORDON-HAGERTY. Thank you.

Since being sworn in 3 weeks ago, I have had the opportunity to learn in depth about many of NNSA's programs and projects, and I still have a great deal more to learn. But what I have seen so far is impressive. From steady progress towards infrastructure modernization to flight qualification tests of the B–61–12, removals of highly enriched uranium from Ghana and the Republic of Kazakhstan to the commissioning to a new class of nuclear-powered aircraft carriers, NNSA has lent its world-class expertise to keeping our Nation safe and secure with the support of this subcommittee and Congress. But there is much more to be done to meet the challenges posed by the current geopolitical environment.

The President's fiscal year 2019 budget request for NNSA is $15.1 billion, providing the resources required to help ensure we are able to protect our Nation and keep our allies safe. And this

request also moves us toward a deterrent that is modern, robust, flexible, resilient, ready, and appropriately tailored as outlined in the 2018 Nuclear Posture Review.

The fiscal year 2019 budget request clearly demonstrates the administration's strong support of the NNSA and its three enduring missions: maintaining the safety, security, reliability, and effectiveness of the U.S. 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.

NNSA's fiscal year 2019 budget request for weapons activities account is $11 billion, an increase of 7.6 percent over the fiscal year 2018 request to ensure we are able to achieve and maintain necessary capabilities. This funding supports the Nation's current and future defense posture, including infrastructure across the nuclear security enterprise. This budget request supports our three life extension programs and major alteration and advances recapitalization and modernization of our Cold War-era infrastructure.

The fiscal year 2019 budget request also includes $1.9 billion for defense nuclear nonproliferation account, a 3.9 percent increase above the fiscal year 2018 request. This funding continues NNSA's far-reaching activities around the world to prevent proliferation of nuclear weapons, counter the threat of nuclear terrorism, and respond to nuclear or radiological incidents.

The budget request for naval reactors is $1.8 billion, a 20.9 percent increase above the fiscal year 2018 request. In addition to supporting today's operational fleet, this request sustains Naval Reactors' ability to deliver tomorrow's fleet. It consists of three key projects: developing the *Columbia*-class reactor plant, refueling a research and training reactor in New York, and building a new spent fuel handling facility in Idaho.

But paramount to all of our endeavors is our modernization effort. There is no longer margin for delay in modernizing NNSA's scientific, technical, and engineering capabilities and recapitalizing the infrastructure needed to produce strategic materials and components for U.S. nuclear weapons. NNSA's talented cadre of federal employees and partners at our laboratories, plants, and sites need these tools to overcome the complex challenges facing our nuclear security mission.

The budget request for federal salaries and expenses is $422.5 million. This request provides funding for 1,715 full-time equivalents, for effective program management and appropriate oversight of the nuclear security enterprise. Of note, since 2010, NNSA's program funding has increased 50 percent while our staffing has decreased by 10 percent.

NNSA's fiscal year 2019 budget request is the result of a disciplined process to prioritize funding for validated requirements as designated by the administration and it sets the foundation to implement policies from the Nuclear Posture Review and the National Security Strategy.

Thank you for your strong support of this subcommittee and the opportunity to testify before you today. I stand ready to answer any questions you may have. Thank you.

[The prepared statement of Secretary Gordon-Hagerty follows:]

PREPARED STATEMENT BY SECRETARY LISA E. GORDON-HAGERTY

Chairman Fischer, Ranking Member Donnelly, and Members of the Subcommittee, thank you for the opportunity to present the President's fiscal year (FY) 2019 budget request for the Department of Energy's (DOE) National Nuclear Security Administration (NNSA). NNSA deeply appreciates the Committee's strong support for the nuclear security mission and for the extraordinary people and organizations that are responsible for its execution.

The President's fiscal year 2019 budget request for NNSA is $15.1 billion, an increase of $1.2 billion or 8.3 percent over the fiscal year 2018 request. The request represents approximately 50 percent of DOE's total budget. This budget request demonstrates the Administration's strong support for NNSA and reinforces the recently released Nuclear Posture Review (NPR) and National Security Strategy (NSS). We will continue to work with the Department of Defense (DOD) to determine the resources, time, and funding required to address policies laid out in the NPR, including the potential low yield ballistic missile warhead, sea launched cruise missile, and B83–1 gravity bomb. We live in an evolving international security environment that is more complex and demanding than any since the end of the Cold War, which necessitates a national commitment to maintain modern and effective nuclear forces and infrastructure. To remain effective, however, recapitalizing our Cold War legacy nuclear forces is critical.

NNSA's enduring missions remain vital 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. The President's fiscal year 2019 budget request is reflective of this Administration's strong support for NNSA and ensures that U.S. nuclear forces are modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st-century threats and reassure America's allies.

Attracting, training, and retaining a skilled and experienced workforce is critical to NNSA's ability to accomplish its diverse missions. NNSA's dedicated and highly talented cadre of Federal employees and Management and Operating (M&O) contract partners must be supported with the tools necessary to support the complex and challenging responsibilities found only within NNSA's nuclear security enterprise. NNSA's infrastructure is in a brittle state that requires significant and sustained investments over the coming decade to correct. There is no margin for further delay in modernizing NNSA's scientific, technical, and engineering capabilities, and recapitalizing our infrastructure needed to produce strategic materials and components for U.S. nuclear weapons.

The fiscal year 2019 budget request also reflects the close partnerships between NNSA and other federal departments and agencies. NNSA collaborates with DOD to meet military requirements, support the Nation's nuclear deterrent, and modernize the nuclear security enterprise. NNSA also partners with a range of federal agencies, to prevent, counter, and respond to nuclear proliferation and nuclear terrorism.

NNSA is mindful of its obligation to be responsible stewards of the resources entrusted by Congress and the American taxpayers. Our fiscal year 2019 budget request is the result of a disciplined process to prioritize funding for validated requirements as designated by the Administration and sets the foundation to implement policies from the NPR and NSS.

WEAPONS ACTIVITIES APPROPRIATION

The fiscal year 2019 budget request for the Weapons Activities account is $11.0 billion, an increase of $777.7 million or 7.6 percent over fiscal year 2018 request levels. Nuclear deterrence remains the bedrock of America's national security. Given the criticality of effective U.S. nuclear deterrence to the safety of the American people, allies, and partners, there is no doubt that NNSA's sustainment and replacement program should be regarded as both necessary and affordable. The programs funded in this account support the Nation's current and future defense posture and the associated nationwide infrastructure of science, technology, and engineering capabilities.

The Weapons Activities account supports the maintenance and refurbishment of nuclear weapons to maintain 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. This account also includes investments in enterprise-wide infrastructure sustainment activities, physical and cybersecurity activities, and the secure transportation of nuclear materials.

Maintaining the Stockpile

This year, the work of the science-based Stockpile Stewardship Program again supported the Secretaries of Energy and Defense in certifying to the President for the 22nd 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 through the work accomplished by NNSA's world-class scientists, engineers, and technicians, and through investments in state-of-the-art diagnostic tools, high performance computing platforms, and modern facilities.

For *Directed Stockpile Work (DSW),* the fiscal year 2019 budget request is $4.7 billion, an increase of $689.0 million or 17.3 percent over the fiscal year 2018 request. Included within this request is funding to support the life extension programs (LEPs) for the W76, B61, and W80, and a major alteration of the W88; and advance the ground based strategic deterrent, by one year to 2019, and investigate feasibility of interoperable aspects for other types of warheads. These LEPs are aligned with the needs outlined in the NPR and with the approved Nuclear Weapons Council strategic plan.

- *W76–1 LEP:* The $113.9 million requested for the W76–1 LEP directly supports the sea-based leg of the nuclear triad by extending the service life of the original W76–0 warhead. With continued funding, the W76–1 LEP will remain 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 that will consolidate four variants of the B61 gravity bomb. This LEP will meet military requirements for reliability, service-life, field maintenance, safety, and use control while also addressing multiple components nearing end of life in this oldest nuclear weapon in the stockpile. With the $794.0 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. 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 and bolster central deterrence for the United States while also providing extended deterrence to America's allies and partners.
- *W88 Alteration 370 Program:* Currently in the Production Engineering Phase (Phase 6.4), the W88 Alt 370 is on schedule, with FPU planned in December 2019. The budget request for this program, which also supports the sea-based leg of the nuclear triad, is $304.3 million in fiscal year 2019.
- *W80–4 LEP:* The current air-launched cruise missile delivers a W80 warhead first deployed in 1982. Both the missile and the warhead are well past planned end of life and are exhibiting aging issues. To maintain this vital deterrent capability, NNSA requests $654.8 million in fiscal year 2019, an increase of $255.7 million or 64.1 percent over the fiscal year 2018 request to extend the W80 warhead, through the W80–4 LEP, for use in the Air Force's Long Range Stand-Off (LRSO) cruise missile. This funding supports a significant increase in program activity through the Design Definition and Cost Study Phase on a timeline consistent with the DOD's LRSO missile platform modernization schedule.
- *Interoperable Warhead 1 (IW1):* The IW1 program will replace one of the oldest warheads in the stockpile, and provide improved warhead security, safety, and use control. To replace the Air Force employed W78 warhead, NNSA is requesting $53.0 million to support the scheduled restart of the feasibility study and design options work suspended in 2014. Technology development efforts are focused on supporting the W78 warhead replacement and investigate the feasibility of interoperable aspects for other types of warheads. To reduce risk, investments will initially be made against technologies that are less than technology readiness level 5.

Within DSW, the fiscal year 2019 budget request includes $619.5 million for Stockpile Systems. This program sustains 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.

The DSW also requests $1.1 billion for Stockpile Services to support the modernization of capabilities to improve efficiency of manufacturing operations to meet future requirements. The Stockpile Services request supports all DSW operations by funding programmatic and infrastructure management, and maintaining the core

competencies and technologies essential for reliable and operable stewardship capabilities.

Strategic Materials are key for the safety, security, and effectiveness of the Nation's nuclear deterrent and are used for addressing national security concerns such as nuclear nonproliferation and counterterrorism missions. The requested 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.

- *Strategic Materials Sustainment:* The $218.8 million for the Strategic Materials Sustainment program will develop and implement strategies to maintain the technical base for strategic materials in support of NNSA's nuclear weapons, non-proliferation, and naval reactors activities at NNSA's eight sites.
- *Uranium Sustainment:* Funding for Uranium Sustainment supports the program to maintain existing enriched uranium capabilities through enhanced equipment maintenance while preparing to phase out mission dependency on Building 9212, a Manhattan Project-era production facility at the Y–12 National Security Complex (Y–12) in Oak Ridge, Tennessee. The funding request of $87.2 million will assist NNSA in sustaining uranium manufacturing capabilities while accelerating planning and execution of the Building 9212 Exit Strategy to reduce risks associated with transitioning enriched uranium capabilities to the Uranium Processing Facility (UPF) that is under construction.
- *Plutonium Sustainment:* The $361.3 million requested for Plutonium Sustainment supports continued progress to meet pit production requirements. The requested funding increase would support efforts to begin the long term plan to develop a capability to produce no fewer than 80 W87-like war reserve pits per year by 2030, as directed in the NPR.
- *Tritium Sustainment:* The fiscal year 2019 budget request of $205.3 million will support the Nation's capacity to provide the tritium necessary for national security requirements. Tritium will be produced 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 at the SRS Tritium Extraction Facility.
- *Lithium Sustainment:* The fiscal year 2019 budget request establishes a separate Lithium Sustainment Program of $29.1 million that supports a Lithium Bridging Strategy to maintain the production of the nation's enriched lithium supply in support of the nuclear security mission, DOE's Office of Science, and DHS.
- *Domestic Uranium Enrichment:* The DUE program, with a request of $100.7 million in fiscal year 2019, will continue efforts to make available when needed the necessary supplies of enriched uranium for a variety of national security needs.

For *Research, Development, Test, and Evaluation (RDT&E),* the fiscal year 2019 budget request is $2.0 billion, a decrease of $33.0 million or 1.6 percent below the fiscal year 2018 request.

Increases for the Science Program ($564.9 million) provide additional funding to support subcritical experiments for pit reuse and advanced diagnostics for subcritical hydrodynamic integrated weapons experiments that produce key data for stockpile certifications.

The Engineering Program ($211.4 million) sustains NNSA's capability for creating and maturing advanced toolsets and technologies to improve weapon surety and support annual stockpile assessments.

The Inertial Confinement Fusion Ignition and High Yield Program in fiscal year 2019 ($418.9 million) will continue to build upon prior accomplishments. These efforts continue to provide key data to reduce uncertainty in calculations of nuclear weapons performance and improve the predictive capability of science and engineering models in high-pressure, high-energy, high-density regimes.

The RDT&E request for fiscal year 2019 includes $703.4 million for the Advanced Simulation and Computing (ASC) Program, and continues NNSA's program of collaboration with DOE's Office of Science to implement DOE's Exascale Computing Initiative. NNSA's ASC Program will support stockpile stewardship by developing and deploying predictive simulation capabilities for nuclear weapons systems. NNSA is taking major steps in high-performance computing by deploying increasingly powerful computational capabilities at both Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory.

The *Secure Transportation Asset (STA)* program provides safe, secure movement of nuclear weapons, special nuclear material, and weapon components to meet pro-

jected DOE, DOD, and other customer requirements. The Office of Secure Transportation has an elite workforce performing sensitive and demanding work; agents are among the most highly trained and dedicated national security personnel operating within the United States. The fiscal year 2019 budget request of $278.6 million continues our efforts to modernize and replace the existing fleet of transporters and efforts to hire and train an additional 40 agents. The fiscal year 2019 funding also supports the Safeguards Transporter (SGT) risk reduction initiatives to extend the life of the SGT to meet the STA mission capacity.

NNSA's Office of Defense Programs also maintains the vitality of the broader nuclear security enterprise that supports other agencies' nuclear missions. An important aspect of this effort is investment in Laboratory, Site and Plant Directed Research and Development. As confirmed by independent reviews, this type of defense research and development investment provides basic research funding to foster innovation and to attract and retain scientific and technical talent and is critical to the long-term sustainment of our national laboratories.

Improving Safety, Operations, and Infrastructure

NNSA's diverse national security missions are dependent upon the safety and reliability of its infrastructure. More than half of NNSA's facilities are over 40 years old, and roughly 30 percent date back to the Manhattan Project era. If left unaddressed, the condition and age of NNSA's infrastructure will put NNSA's missions, the safety of its workforce, the public, and the environment at risk. As reaffirmed in the NPR, "An effective, responsive, and resilient nuclear weapons infrastructure is essential to the U.S. capacity to adapt flexibly to shifting requirements. Such an infrastructure offers tangible evidence to both allies and potential adversaries of U.S. nuclear weapons capabilities and can help to deter, assure, hedge against adverse developments, and discourage adversary interest in arms competition." The fiscal year 2019 budget request for Infrastructure and Operations is $3.0 billion, an increase of $199.6 million or 7.1 percent above the fiscal year 2018 request. The Fiscal Year 2018 National Defense Authorization Act provided NNSA and its M&O partners with additional flexibility to address the challenges of modernizing the enterprise by increasing the minor construction threshold to $20 million. This reform supports efforts to address deferred maintenance through recapitalization projects that improve the condition and extend the design life of structures, capabilities, and systems to meet NNSA's nuclear weapons and nonproliferation program needs.

The fiscal year 2019 budget request for Infrastructure and Operations includes $1.1 billion for Line Item Construction projects. The requested amount provides the remaining funding of $48.0 million for the Albuquerque Facility, supports UPF at Y–12 ($703.0 million), and continues the Chemistry and Metallurgy Research Replacement project at LANL ($235.1 million). The fiscal year 2019 budget also includes $19.0 million in funding to begin the first steps toward the construction of a new lithium production facility and $6 million for the 138kV Power Transmission System Replacement project to replace and upgrade the current power transmission system for the Mission Corridor at NNSS. Delivering these projects on budget and schedule is contingent upon stable and predictable funding profiles, and the President's budget request being supported.

Many of NNSA's excess process-contaminated facilities will ultimately be transferred to DOE's Office of Environmental Management for disposition. In the interim, NNSA is focusing on reducing risks where possible. For example, NNSA has made critical investments to stabilize high-risk process contaminated facilities until ultimate disposition, including at Y–12's Alpha 5 and Beta 4 facilities. NNSA also remains committed to reducing the risk of non-process contaminated facilities by dispositioning facilities where possible. In late 2017, NNSA, with the support of Congress, completed the transfer to a private developer of over 200 acres of the aging Bannister Federal Complex in Kansas City, Missouri, eliminating $300 million of repair needs.

Later this spring, completion of the Pantex Drummond Office Building (formerly known as the Administrative Support Complex) at the Pantex Plant outside of Amarillo, Texas will allow NNSA to move nearly 1,000 employees into a modern, energy efficient workspace. After completion of the Pantex Drummond Office building NNSA will also be able to dispose of dilapidated, 1950s-era buildings and eliminate approximately $20 million in deferred maintenance.

Defense Nuclear Security's (DNS) fiscal year 2019 budget request is $690.6 million, an increase of $3.7 million or 0.5 percent over the fiscal year 2018 request. To execute its enterprise security program, DNS provides funding to the sites for: protective forces, physical security systems, information security and technical security, personnel security, nuclear material control and accountability, and security pro-

gram operations and planning. The request manages risk among important, competing demands of the physical security infrastructure and includes planning and conceptual design funds for a series of future projects to sustain and recapitalize the Perimeter Intrusion Detection and Assessment Systems at the Pantex Plant and Y–12. Preliminary estimates are included within the recently completed *10-year Physical Security Systems Refresh Plan*. Future budget requests will reflect refined and detailed funding requirements.

Information Technology and Cybersecurity enable every element of NNSA's missions. The fiscal year 2019 budget request is $221.2 million, an increase of $34.4 million, or 18.4 percent over the fiscal year 2018 request. The cybersecurity program continuously monitors enterprise wireless and security technologies to meet a wide range of security challenges. The requested funding increase will be used to continue working toward a comprehensive information technology and cybersecurity program to deliver secure crucial information assets. The funding will continue to mature the cybersecurity infrastructure, comprising almost 100 sensors and over 70 data acquisition servers located across the Nation.

DEFENSE NUCLEAR NONPROLIFERATION APPROPRIATION

The fiscal year 2019 budget request for the Defense Nuclear Nonproliferation account is $1.9 billion, an increase of $69.5 million or 3.9 percent above the fiscal year 2018 request. Defense Nuclear Nonproliferation account activities address the entire nuclear threat spectrum by helping to prevent the proliferation of nuclear weapons, counter the threat of nuclear terrorism, and respond to nuclear and radiological incidents around the world. The fiscal year 2019 budget request funds two program mission areas under the Defense Nuclear Nonproliferation account: the Defense Nuclear Nonproliferation (DNN) Program and the Nuclear Counterterrorism and Incident Response (NCTIR) Program.

Nonproliferation Efforts

The Office of Defense Nuclear Nonproliferation works with international partners to remove or eliminate vulnerable nuclear material; improve global nuclear security through multilateral and bilateral technical exchanges and training workshops; help prevent the illicit trafficking of nuclear and radioactive materials; secure domestic and international civilian buildings containing high-priority radioactive material; provide technical reviews of U.S. export license applications; conduct export control training sessions for U.S. enforcement agencies and international partners; strengthen the International Atomic Energy Agency's ability to detect and deter nuclear proliferation; advance U.S. capabilities to monitor arms control treaties and detect foreign nuclear programs; and maintain 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 2019 budget request is $332.1 million. The request supports the conversion or shutdown of research reactors and isotope production facilities that use highly enriched uranium (HEU) and acceleration of new, non HEU-based molybdenum-99 production facilities in the United States, which recently contributed to the approval of the first Food and Drug Administration-approved U.S.-origin technology to produce the medical isotope. Additionally, the request for M3 supports the removal and disposal of weapons usable nuclear material and continues the transition to the dilute and dispose strategy for surplus plutonium disposition, including the completion of the independent validation of lifecycle cost estimate and schedule for the dilute and dispose strategy.

The *Global Material Security* program works with partner nations to increase the security of vulnerable nuclear and radioactive materials and improve ability to deter, detect, and investigate illicit trafficking of these materials. The fiscal year 2019 budget request for this program is $337.1 million and includes efforts to secure the most at-risk radioactive material in U.S. high-threat urban areas by 2020.

The *Nonproliferation and Arms Control* 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 enduring and emerging proliferation challenges requiring the development of innovative policies and approached. The fiscal year 2019 budget request for this program is $129.7 million. 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 *Defense Nuclear Nonproliferation Research and Development* program supports innovative unilateral and multilateral technical capabilities to detect, identify,

and characterize foreign nuclear weapons programs, illicit diversion of special nuclear material, and nuclear detonations worldwide. The fiscal year 2019 budget request for this program is $456.1 million.

Nonproliferation Construction consolidates construction costs for DNN projects. The fiscal year 2019 budget request is $279.0 million. As in fiscal year 2018, the Administration proposes termination activities for the Mixed Oxide (MOX) Fuel Fabrication Facility project and continuing to pursue the dilute and dispose option to fulfill the United States' commitment to dispose of 34 metric tons of plutonium. The $220.0 million for the MOX Facility will be used to continue terminating the project and to achieve an orderly and safe closure. The scope and costs will be refined in subsequent budget requests when the termination plan for the MOX project is approved. The request also includes $59.0 million for the Surplus Plutonium Disposition project to support the dilute and dispose strategy.

Nuclear Counterterrorism and Incident Response (NCTIR)

The fiscal year 2019 budget request for NCTIR is $319.2 million, an increase of $41.8 million or 15.1 percent over the fiscal year 2018 request. NNSA's Counterterrorism and Counterproliferation (CTCP) program is part of broader U.S. Government efforts to assess the threat of nuclear terrorism and develop technical countermeasures. The scientific knowledge generated by this program underpins the technical expertise for disabling potential nuclear threat devices, including improvised nuclear devices, supports and informs U.S. nuclear security policy, and guides nuclear counterterrorism and counterproliferation efforts, including interagency nuclear forensics and contingency planning.

The *Counterterrorism and Counterproliferation* program provides a flexible, efficient, and effective response capability for any nuclear/radiological incident in the United States or abroad by applying the unique technical expertise across NNSA's nuclear security enterprise. Appropriately trained personnel and specialized technical equipment are ready to deploy to provide an integrated response for radiological search, render safe, and consequence management for nuclear/radiological emergencies, national exercises, and security operations for large National Security Special Events.

The CTCP program maintains an operational nuclear forensics capability for predetonation device disassembly and examination, provides operational support for post-detonation assessment, and coordinates the analysis of special nuclear materials. Readiness is maintained to deploy device disposition and device assessment teams, conduct laboratory operations in support of analysis of bulk actinide forensics, and to deploy subject matter expertise and operational capabilities in support of ground sample collections that contribute to conclusions in support of attribution.

NNSA's Aerial Measuring System (AMS) provides airborne remote sensing in the event of a nuclear or radiological accident or incident within the continental United States, as well as in support of high-visibility national security events.

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 age of the current aircraft leads to unscheduled downtime resulting in reduced mission availability. A recently concluded Analysis of Alternatives on the AMS aircraft determined that recapitalization of the aging aircraft fleet is necessary to continue to provide Federal, state, and local officials with rapid radiological information following an accident or incident. The fiscal year 2019 budget requests $32.5 million as part of a two-year replacement process for the five aircraft.

The equipment used by NNSA's emergency response teams is aging, resulting in increasing maintenance costs and increasing risks to the emergency response mission. This budget includes funding for incremental recapitalization of incident response equipment consistent with lifecycle planning to maintain operational readiness. This budget also includes funding for state-of-the-art, secure, deployable communications systems that are interoperable with the Federal Bureau of Investigation and DOD mission partners that will help provide decision makers with real-time technical recommendations to mitigate nuclear terrorist threats.

The *Emergency Operations* program's fiscal year 2019 budget request includes $36 million under NCTIR to support NNSA's Office of Emergency Operations. This funding will support NNSA's all hazard emergency response capabilities, such as providing incident management training and exercise planning, and managing the Emergency Communications Network capability for the Department.

NAVAL REACTORS APPROPRIATION

Advancing Naval Nuclear Propulsion

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

The *Naval Reactors* fiscal year 2019 budget request is $1.8 billion, an increase of $308.9 million or 20.9 percent above the fiscal year 2018 request. In addition to supporting today's operational fleet, the requested funding is the foundation for Naval Reactors to deliver tomorrow's fleet and recruit and retain a highly-skilled workforce. One of Naval Reactors' three national priority projects, continuing design and development of the reactor plant for the *Columbia*-class submarine, featuring a life-of-ship core and electric drive, will replace the current *Ohio*-class fleet and provide required deterrence capabilities for decades. The project to refuel a Research and Training Reactor in New York will facilitate *Columbia*-class reactor development efforts to provide 20 more years of live reactor-based training for fleet operators. Funding will also be used to support construction of 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 2019 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. The laboratories also perform the technical evaluations that enable Naval Reactors to thoroughly assess emergent issues and deliver timely responses to provide nuclear safety and maximize operational flexibility.

NNSA FEDERAL SALARIES AND EXPENSES APPROPRIATION

The NNSA *Federal Salaries and Expenses* fiscal year 2019 budget request is $422.5 million, an increase of $3.9 million or 0.9 percent over the fiscal year 2018 request. The fiscal year 2019 budget request provides funding for 1,715 full-time equivalents for the effective program and project management and appropriate oversight of the nuclear security enterprise. Since 2010, NNSA's program funding has increased 50 percent, while staffing has decreased 10 percent. NNSA has partnered with the Office of Personnel Management to develop a staffing analysis, now in its second phase, of a Human Capital Management Plan that assesses current personnel levels compared to mission needs. The results of the staffing analysis will be used to inform future recommendations on appropriate staff size and provide the type and number of scientists, engineers, project managers, foreign affairs specialists, and support staff needed to accomplish the mission. Part of the evaluation includes a review of current staff skill sets and areas where skills are needed for project and program management, applicable oversight, and day to day operations of the nuclear security enterprise.

Thanks to the support of Congress, NNSA received a 10-year extension to continue to use the Demonstration Project personnel system. The pay for performance personnel system provides an important tool to retain and attract top talent for NNSA's national security missions. With the pay to perform personnel system, we are able to compete for personnel with other highly technical federal and private organizations, motivate and retain high-performing employees, and deal with poor performers. NNSA uses the Demonstration Project in conjunction with the Excepted Service hiring authorities to hire key personnel for the current and next generation workforce with critical nuclear security expertise.

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. We are committed to encouraging competition and increasing the universe of qualified contractors by streamlining major acquisition processes. NNSA will continue to focus on delivering

timely, best-value acquisition solutions for all programs and projects, by using a tailored approach to contract structures and incentives that is appropriate for the special missions and risks at each site. The Office of Acquisition and Project Management continues to lead improvements in contract and project management practices; 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 and enduring national security missions are crucial to the security of the United States, the defense of its allies and partners, and global stability. The U.S. nuclear deterrent has and will continue to remain the cornerstone of America's national security, and NNSA has unique responsibilities to maintain and certify the continued safety, security, reliability, and effectiveness of that nuclear deterrent.

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 and technology around the world. Providing naval nuclear propulsion to the U.S. Navy is crucial to the United States to defend 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, Madam Secretary.

With that, I will recognize Senator Donnelly, the ranking member, for opening comments.

STATEMENT OF SENATOR JOE DONNELLY

Senator Donnelly. Thank you, Madam Chair.

I want to start by thanking Senator Fischer for holding today's hearing. 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.

Let me also thank today's witnesses for joining us to testify on the fiscal year 2019 budget request for defense programs at Department of Energy. Today's hearing is wide-ranging from supporting the DOD [Department of Defense] and our nuclear deterrent to detecting smuggled nuclear materials around the world to cleaning up former defense production sites. In all of these, the key issue is effective use of the taxpayers' dollar.

Administrator Gordon-Hagerty, congratulations on your confirmation and welcome to the subcommittee.

The NNSA's stockpile program is experiencing the highest demand since the mid-1980s. They are now up to six major programs, all concurrent with each other. The credibility of the NNSA to meet the Department of Defense requirements is on the line, and you and your team have a big challenge to rise up to and we must meet that.

Admiral Caldwell, it is good to see you again. I look forward to hearing from you about progress on the *Columbia*-class submarine and ongoing infrastructure modernization across the Naval Reactors complex.

Mr. Owendoff, over the 20 years, your program has cleaned up 91 of the 107 sites. But now we have the most challenging, especially at Hanford with its 55 million gallons of liquid waste. Your total liability continues to grow, which the GAO [Government Accountability Office] estimates at $383 billion. Half of that liability is at Hanford and Savannah River. Time is your enemy for this li-

ability, and we must try to get these sites done as quickly and safely as possible.

Mr. Trimble, as always we are grateful for you and your staff on the excellent work your team undertakes for this subcommittee. You play a critical role in oversight of the work underway at the Department of Energy. I look forward to your testimony.

I want to thank Ranking Member Reed for being here with us today as well. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator Donnelly.

Mr. Owendoff, if you would give us an update on Environmental Management in your opening comments please.

STATEMENT OF JAMES M. OWENDOFF, ACTING ASSISTANT SECRETARY FOR ENVIRONMENTAL MANAGEMENT, DEPARTMENT OF ENERGY

Mr. OWENDOFF. Good afternoon, Chairman Fischer, Ranking Member Donnelly, Senator Peters, Senator Reed, and members of the subcommittee. I am pleased to be here today to represent the Department of Energy's Office of Environmental Management and to discuss what we plan to accomplish under the President's fiscal year 2019 budget request.

The total fiscal year 2019 budget request for the EM program is $6.6 billion. Of that, $5.6 billion is defense environmental cleanup activities. This request is the highest for the EM program in a decade and is an increase of $93 million from the fiscal year 2018 request, which was also record request. The fiscal year 2019 request demonstrates the administration's continued commitment to the vital mission of EM to address the environmental legacy of nuclear weapons production and government-sponsored nuclear energy research.

DOE and EM are committed to ensuring the safety of our workforce, the public, and the environment. Safety is the top priority for the Office of Environmental Management and its field sites. It is valued above production, budget, and schedule. We are also strongly committed to a workplace where all workers, federal and contractor, are free to speak out, voice concerns, or lodge complaints without fear of retaliation.

To continue and further build upon our momentum of progress, we have focused on a greater sense of urgency to EM's decision-making process. This approach means more emphasis on engaging with regulators, stakeholders, and communities in making timely decisions which will enhance safety, shorten schedules, increase transparency, and reduce costs. This will enable us to achieve the best value for all taxpayers while at the same time protecting our workers, members of the public in the communities surrounding our sites and the environment.

Going forward, our fiscal year 2019 request will enable us to continue making progress on those capabilities necessary to tackle some of our longer-term challenges while also enabling us to realize concrete accomplishments across the EM program.

At Savannah River, the request will enable DOE to significantly increase processing of radioactive waste and closure of underground tanks. As a result, the site will be able to significantly build

on its record to date of successfully emptying and closing those tanks.

The WIPP [Waste Isolation Pilot Plant] request will have benefits across the EM program with the planned infrastructure improvements intended to enable increased true waste shipments from other EM sites.

We will continue to enhance those portions of the Hanford Waste Treatment and Immobilization Plant necessary to initiate tank waste treatment through the direct feed, low-activity waste approach and complete design and launch site preparations for the Oak Ridge Mercury Treatment Facility, which will help address the mercury contamination at the site and aid in the eventual D&D [Dilute and Dispose] of deteriorating facilities at the Y–12 National Security Complex.

We will also complete targeted, buried waste exhumation at the Idaho site and continue implementation of an interim measure to address chromium groundwater contamination at the Los Alamos National Laboratory, among other projects.

In closing, I am honored to be here today representing the more than 20,000 men and women that carry out the Office of Environmental Management mission. Ensuring a safe environment at all of our sites is our highest priority. We are committed to achieving our mission in a safe, effective, and cost efficient manner to serve as good stewards of taxpayer resources.

Thank you again for the opportunity to appear before you today, and I look forward to your questions.

[The prepared statement of Mr. Owendoff follows:]

PREPARED STATEMENT BY JAMES OWENDOFF

Thank you for the opportunity to appear before you today to represent the Department of Energy's (DOE) Office of Environmental Management (EM). I would like to provide you with an overview of the EM program, key accomplishments during the past year and what we plan to accomplish under the President's $6,601,366,000 fiscal year (FY) 2019 budget request, which includes $5,630,217,000 in Defense Environmental Cleanup. This request demonstrates the Administration's continued commitment to the vital mission of EM to address the environmental legacy of nuclear weapons production and government-sponsored nuclear energy research.

OVERVIEW OF THE EM MISSION

The Federal Government's nuclear weapons production programs have made significant contributions to our Nation's defense for decades—helping end World War II and the Cold War. In addition, government-sponsored nuclear energy research also made significant contributions to domestic energy growth and prosperity. The legacy of these programs is a massive amount of radioactive and chemical waste and contaminated facilities at sites across the country. It is the mission of DOE's Office of Environmental Management to clean up or remediate this legacy waste.

This legacy includes 90 million of gallons of radioactive liquid waste stored in aging underground tanks. That's enough to completely fill the Capitol Rotunda nearly 10 times.

This legacy also includes five thousand contaminated facilities, 700,000 tons of depleted uranium, millions of cubic meters of contaminated soil, billions of gallons of contaminated water, used nuclear fuel and other nuclear materials.

EM must execute its mission as safely, efficiently and cost-effectively as possible. This involves constructing new infrastructure like waste storage facilities and waste treatment plants. This mission also involves the management and retrieval of liquid tank waste as well as the decommissioning and demolition of deteriorating facilities that ultimately reduce maintenance and monitoring costs.

The nature and length of the EM mission, coupled with the sheer technological complexity of cleanup means that we will always face challenges—some anticipated

and others unexpected. These obstacles certainly warrant our careful attention, but EM also has a proven ability to achieve tangible results.

When the program began in 1989, EM was responsible for a total of 107 sites covering 3,100 square miles. That's an area larger than Rhode Island and Delaware combined. During early years, work focused on characterizing waste. Since then, EM's accomplishments have included 1) cleanup and closure of major sites in Colorado, Ohio, Missouri and Florida; 2) decommissioning of a gaseous diffusion enrichment plant in Tennessee; 3) vitrification of more than 4,000 canisters of high-level waste in South Carolina; and) removal of all the plutonium metal and oxides from Washington state.

Today, EM has 16 sites remaining, with an active cleanup footprint of less than 300 square miles. These 16 sites are home to some of our toughest and most complex challenges.

The best value does not mean taking short cuts and it does not always mean choosing the cheapest option. It means getting the job done as safely, efficiently and cost-effectively as possible. It requires a sustainable, risk-informed approach centered on reducing the greatest amount of risk with the resources available, while maximizing opportunities to shorten schedules and lower lifecycle costs.

That is why we have focused on a greater sense of urgency to EM's decision-making process. This approach means more emphasis on engaging with regulators, stakeholders, and communities in making timely decisions which will enhance safety, shorten schedules, increase transparency, and reduce costs—achieving the best value for all taxpayers, while at the same time, protecting our workers, members of the public in the communities surrounding our sites, and the environment.

EM's first priority is worker safety, as well as protection of the public health and the environment. These are essential components of our cleanup objectives. EM will continue to discharge its responsibilities by conducting cleanup within a "Safe Performance of Work" culture that integrates protection of the environmental, safety, and protection of worker and public health into all work activities.

The December spread of contamination that occurred during demolition activities at the Plutonium Finishing Plant at the Hanford site demonstrate the continued need to ensure a safe working environment at all of our sites. We will continue to engage with the workforce at Hanford and our other EM sites to solicit their input and ideas to further strengthen our safety performance.

EM CLEANUP OBJECTIVES AND PRIORITIES

Taking many variables into account, such as risk reduction and compliance agreements, EM has the following priorities:

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

In particular, the fiscal year 2019 budget request will allow EM to:

- Ramp up efforts to address the largest environmental risk at the Savannah River Site—-radioactive tank waste.
- Implement key infrastructure improvements at the Waste Isolation Pilot Plant (WIPP), integral to the cleanup activities at a number of EM sites.
- Complete design and begin site preparations for the Oak Ridge Mercury Treatment Facility, which will help address mercury contamination at the site and aid in the eventual deactivation and decommissioning (D&D) of aging facilities at the Y–12 National Security Complex.

KEY RECENT ACCOMPLISHMENTS

While some cleanup projects will extend decades, stable steady progress is being made right now. In 2017, the EM workforce achieved the resumption of transuranic waste shipments to WIPP, enabling continued cleanup progress at several sites across the country.

At Savannah River, workers successfully completed construction of the latest Saltstone Disposal Unit, which is integral to the tank waste cleanup mission, ahead of schedule and under budget. We also completed cleanup activities at Hanford's 618–10 burial ground; demolition of one of the last remaining buildings at the Separations Process Research Unit in New York state; and the safe treatment of remediated nitrate salt drums at the Los Alamos National Laboratory. At the Portsmouth site, we are continuing work to deactivate the former enrichment plant's massive process buildings to prepare them for eventual demolition. And at the Paducah site,

we have optimized a system to control and mitigate the migration of groundwater contamination on the east side of the site ahead of schedule and under budget.

Our successes have been recognized by the Project Management Institute (PMI). Our work to complete waste retrieval activities at the AY–102 double-shell tank at Hanford was awarded PMI's Project of the Year award. In addition, PMI also issued awards for efforts to upgrade a ventilation system at one of Hanford's tank farms and for work to close one of the underground waste tanks at the Savannah River Site. We are proud that the PMI chose to recognize the important work underway to address one of our largest environmental challenges—radioactive tank waste. These awards are a recognition of the dedicated and talented workforce we have at the Hanford and Savannah River sites, and across the entire EM program, and illustrate how the EM program is working to serve as a good steward of taxpayer resources. We are committed to building upon this cleanup momentum.

HIGHLIGHTS OF THE FISCAL YEAR 2019 BUDGET REQUEST

The fiscal year 2019 budget request for EM is $6,601,366,000, which includes $5,630,217,000 for defense environmental cleanup activities, $218,400,000 for non-defense environmental cleanup activities, and $752,749,000 for Uranium Enrichment Decontamination and Decommissioning Fund cleanup activities. This request is the highest for the EM program in a decade, and is an increase of $93,031,000 from the fiscal year 2018 request, which was also a record request.

EM's fiscal year 2019 request provides resources to make progress on cleanup activities across the complex, including tackling the largest environmental challenge at the Savannah River Site—radioactive tank waste; and executing key infrastructure improvements at WIPP, integral to the cleanup activities at a number of EM sites.

At Savannah River, the request will enable DOE to significantly increase production of canisters of vitrified high-level waste at the Defense Waste Processing Facility, as well as support planned operation rates for the Salt Waste Processing Facility, and continued construction progress for Saltstone Disposal Units. As a result, Savannah River will be able to significantly build on its record of successfully emptying and closing underground waste tanks. The WIPP request will have wide-ranging benefits across the EM program, with the planned infrastructure improvements at WIPP intended to enable increased transuranic (TRU) waste shipments from other EM sites.

We will continue to advance those portions of the Hanford Waste Treatment and Immobilization Plant necessary to initiate tank waste treatment through the Direct Feed Low Activity Waste (DFLAW) approach; and complete design and launch site preparations for the Oak Ridge Mercury Treatment Facility, which will help address mercury contamination at the site and aid in the eventual D&D of deteriorating facilities at the Y–12 National Security Complex. We also will complete targeted buried waste exhumation at the Idaho site and continue with preparations to transfer cesium and strontium capsules at Hanford from wet storage to a safer dry storage configuration; and implement of an interim measure to address chromium groundwater contamination at the Los Alamos National Laboratory.

BUDGET AUTHORITY AND PLANNED ACCOMPLISHMENTS BY SITE

Office of River Protection, Washington

(dollars in thousands)

Fiscal Year 2018 Request	Fiscal Year 2019 Request
$1,504,311	$1,438,513

Key Accomplishments Planned for Fiscal Year 2019

- Continue construction, startup and commissioning activities for the Low Activity Waste (LAW) Facility, Analytical Laboratory, Effluent Management Facility, and Balance of Facilities to complete hot commissioning of the LAW Facility by December 31, 2023, per the 2016 Amended Consent Decree;
- Continue design activities for the Low Activity Waste Pretreatment System (LAWPS);
- Pursue a complementary pretreatment capability using tank-side cesium removal equipment to provide initial feed by December 2023 per the 2016 Amended Consent Decree; and
- Continue retrieval of single-shell tanks in A/AX Farm.

Richland Operations Office, Washington
(dollars in thousands)

Fiscal Year 2018 Request	Fiscal Year 2019 Request
$800,422	$747,097

Key Accomplishments Planned for Fiscal Year 2019

- Continue cesium and strontium capsules activities to move capsules currently stored at the Waste Storage Encapsulation Facility to dry storage;
- Continue waste site remediation and groundwater treatment; and
- Continue focus on canyon and waste site risk mitigation.

Savannah River Site, South Carolina
(dollars in thousands)

Fiscal Year 2018 Request	Fiscal Year 2019 Request
$1,447,591	$1,656,180

Key Accomplishments Planned for Fiscal Year 2019

- Package 135 to 175 canisters of vitrified high-level waste at the Defense Waste Processing Facility;
- Support start-up activities for the Salt Waste Processing Facility;
- Continue construction of Saltstone Disposal Unit #7, #8, #9;
- Operate Actinide Removal Process and Modular Caustic Side Solvent Extraction Unit and Tank Closure Cesium Removal system to process 200,000 gallons of salt solution;
- Complete D Area Ash Project including closure of the 488–1D Ash Basin and the Coal Pile Runoff Basin;
- Continue to receive foreign research reactor and domestic research reactor used nuclear fuel for safe storage and management; and
- Disposition used nuclear fuel in H–Canyon by processing.

Idaho National Laboratory, Idaho
(dollars in thousands)

Fiscal Year 2018 Request	Fiscal Year 2019 Request
$359,226	$359,226

Key Accomplishments Planned for Fiscal Year 2019

- Continue commissioning and startup of the Integrated Waste Treatment Unit;
- Characterize, repackage and certify contact-handled transuranic waste for shipment to the Waste Isolation Pilot Plant;
- Complete exhumation of targeted buried waste at the ninth and final retrieval area; and
- Transfer Experimental Breeder Reactor-II and Advanced Test Reactor used (used) nuclear fuel from wet to dry storage.

Oak Ridge Site, Tennessee
(dollars in thousands)

Fiscal Year 2018 Request	Fiscal Year 2019 Request
$390,205	$408,526

Key Accomplishments Planned for Fiscal Year 2019

- Complete design and begins site preparation of the Outfall 200 Mercury Treatment Facility;
- Continue demolition of remaining facilities at East Tennessee Technology Park;
- Continue modifications to Building 2026 to support processing of U–233 material; and
- Initiate design for a new On-Site Waste Disposal Facility.

Carlsbad Field Office, New Mexico
(dollars in thousands)

Fiscal Year 2018 Request	Fiscal Year 2019 Request
$323,041	$403,487

Key Accomplishments Planned for Fiscal Year 2019

- Continue waste emplacement activities, increasing transuranic waste shipments to ten per week ;
- Address major repair or replacement of critical infrastructure; and
- Continue work on the Safety Significant Confinement Ventilation System.

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

Fiscal Year 2018 Request	Fiscal Year 2019 Request
$191,629	$191,629

Key Accomplishments Planned for Fiscal Year 2019

- Continue execution of New Mexico Environment Department approved ground water remedies for the high explosives (RDx) plume in Canon de Valle; and
- Continue activities for chromium plume investigation through modeling, hydrology studies, installation of extraction and injection wells, and interim measure activities progressing towards an approved corrective measure evaluation.

Nevada National Security Site, Nevada
(dollars in thousands)

Fiscal Year 2018 Request	Fiscal Year 2019 Request
$60,136	$60,136

Key Accomplishments Planned for Fiscal Year 2019

- Continue soil and groundwater remediation activities; and
- Continue safe disposal operations for low-level and mixed low-level radioactive waste.

CONCLUSION

I am honored to be here today representing the more than 20,000 men and women that carry out our Office of Environmental Management mission. Ensuring a safe work environment at all of our sites is our highest priority. We are committed to achieving our mission in a safe, effective and cost-efficient manner to serve as good stewards of taxpayer resources.

At the end of the day, EM progress means safer, cleaner sites in the communities that hosted defense nuclear activities for decades. This kind of progress is not possible without our workforce, Members of Congress, regulators, cleanup community leaders and other partners. Thank you again for the opportunity to appear before you today and I look forward to your questions.

[The prepared statement of Admiral Caldwell follows:]

PREPARED STATEMENT BY ADMIRAL JAMES F. CALDWELL

Chairman Fischer, Ranking Member Donnelly, and Members of the Subcommittee, thank you for the opportunity to present the President's fiscal year (FY) 2019 budget request for Naval Reactors. In 1955, the United States experienced a step-change in naval dominance when USS *Nautilus* (SSN 571) reported "Underway on nuclear power". Since *Nautilus,* follow-on classes of ever more capable U.S. nuclear-powered submarines and aircraft carriers have ensured our warfighting edge over potential adversaries. Forward deployed fast attack submarines exert influence throughout the world, safeguarding vital commercial sea-lanes, protecting aircraft carrier and expeditionary strike groups, and operating virtually undetected in all the world's oceans, even under the Arctic ice. Our Navy's ballistic missile sub-

marines provide strategic deterrence capability to our country and have done so for six decades. Virtually undetectable when submerged, these ballistic missile submarines form the most survivable component of the nuclear triad. Our nuclear aircraft carriers provide the nation highly mobile, sustainable, sovereign territory from which to project flexible, rapid, visible, and credible U.S. Military power to keep the peace, deter conflict, and protect American interests around the world. Nuclear propulsion enables these warships to conduct missions vital to national security by providing unique tactical mobility and flexibility, responsiveness, and sustainability—these key attributes ensure our nuclear fleet can meet the demands of forward presence and crisis response world-wide. Today, over 45 percent of the Navy's major combatants are nuclear powered (11 aircraft carriers, 14 ballistic missile submarines, 53 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, with Naval Reactors support, the Navy deployed 39 submarines and conducted 33 strategic deterrent patrols. At any given time, there were at least 49 of 71 submarines deployed or ready to deploy within days. Our carriers, USS *Nimitz* (CVN 68), USS *Dwight D. Eisenhower* (CVN 69), USS *Ronald Reagan* (CVN 76), USS *Theodore Roosevelt* (CVN 71), USS *Carl Vinson* (CVN 70), and USS *George H.W. Bush* (CVN 77) successfully conducted deployments, and this past November, *Reagan, Roosevelt,* and *Nimitz* conducted the first tri-carrier operations in a decade off the Korean Peninsula.

In nuclear shipbuilding, this past year also saw the keel laid for the attack submarines Pre Commissioning Unit (PCU) *Oregon* (SSN 793), the christening of PCU *Indiana* (SSN 789) and PCU *South Dakota* (SSN 790), the delivery of PCU *Colorado* (SSN 788) and finally, the commissioning of USS *Washington* (SSN 787)—the fourteenth *Virginia*-class fast attack submarine to join the fleet. In addition, construction of the aircraft carrier *John F. Kennedy* is well underway and the third carrier of the *Ford*-class, *Enterprise,* starts construction activities this year.

Another recent accomplishment was commissioning USS *Gerald R. Ford* (CVN 78) last July. I personally participated in the sea-trials of this incredible ship which has the first new design aircraft carrier propulsion plant in 40 years. *Ford* matches the high speed of our *Nimitz*-class ships while delivering 25 percent more energy and three times the electrical operating capacity, reduces maintenance by 30 percent, and reduces propulsion plant manpower by 50 percent. 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 (DOE) laboratories, nuclear industrial base suppliers, the Navy design team, and the nuclear shipbuilders.

In addition to supporting the operational nuclear fleet, we continue to safely maintain and operate two nuclear powered land-based prototypes—both over 40 years old—to conduct research, development, and training. We also continue to safely maintain and operate two Moored Training Ships to train our nuclear operators—these are both over 54 years old and are the oldest operating pressurized water reactors in the world. These four platforms allow us to train 2800 students per year and provide highly qualified operators to the nuclear fleet.

The strong support of this subcommittee enabled safe operation of the nuclear fleet, progress on our key projects, and our oversight and regulation on all areas across the Naval Nuclear Propulsion Program. Naval Reactors' budget request for fiscal year 2019 is $1.79 billion, an increase of $309 million, or 21 percent, over the fiscal year 2018 requested level and is consistent with the plan of record provided in previous budget requests for major projects we have underway. This year's request represents our peak budget year in the Future Years Nuclear Security Plan. The overall increase to the budget request is primarily driven by the planned funding ramp for two national priority projects—the refueling overhaul of a research and training reactor in New York, and the construction of the new Naval Spent Fuel Handling Facility in Idaho. The increase also allows research and development efforts for advanced reactor plant components and improved reactor cores for installation on future *Virginia*-class submarines. This reactor plant technology development will also underpin the demanding and critical design requirements of future classes of nuclear powered warships.

MAJOR PROJECTS

This past year marked the peak in our design efforts for the *Columbia*-class strategic ballistic missile submarine propulsion plant. Delivering the life-of-ship reactor core and electric drive propulsion system remains a top priority. The *Columbia*-class is the Navy's number one acquisition priority and we are on track to start reactor

plant component procurement in fiscal year 2019 to support the start of ship construction in fiscal year 2021. Fiscal year 2019 funding of $138 million will provide for propulsion plant component design, development, and testing to support fiscal year 2019 long-lead component contract placement in addition to supporting reactor plant testing and safety analysis.

Fiscal year 2019 marks the start of the land-based prototype refueling overhaul. The $250 million request in this year's budget will support the refueling overhaul which is vital to the nuclear propulsion program, enabling 20 additional years of Naval Reactors' commitment to research, development, and training in New York. As part of this refueling activity, we will insert newly manufactured *Columbia*-class type fuel modules with the prototype refueling reactor core, enabling testing and demonstration of core manufacturability necessary for production and delivery of the *Columbia*-class reactor.

Naval Reactors fiscal year 2019 budget request includes $287 million in construction funding to continue the Spent Fuel Handling Recapitalization Project. The project broke ground last year, and we are conducting site preparation. Full support from Congress has enabled us to keep this project on track and on budget. The total estimated cost for this project remains unchanged. Continued Congressional support will ensure the facility is ready to receive spent nuclear fuel from aircraft carriers in fiscal year 2024 and be fully operational by 2025.

BASE FUNDING

In addition to our three priority projects, Naval Reactors maintains a high-performing technical base to: 1) execute nuclear reactor technology research and development that supports today's fleet and ensures our Navy remains technologically ahead of adversaries and, 2) provide the necessary equipment, construction, maintenance, and modernization of critical infrastructure and facilities. The funding required for this base also supports the lean federal workforce that provides the regulatory oversight necessary to carry out this important technical work safely and efficiently. By employing an 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, the Naval Reactors Facility in Idaho, and our Washington, DC headquarters—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 for tomorrow's fleet. 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.

In the past, I have spoken to the importance of the technical base regarding its support of the nuclear fleet and our essential work on new technologies. This year's budget demonstrates this synergy by developing new technologies that will modify our current *Virginia*-class reactor plant design to advance reactor plant components and deliver improved capabilities for next generation submarines. Investing in these core technologies alone will result in an estimated $50 million per ship savings on future warships relative to current technology.

Additionally, there are two other distinct areas of the base that are essential to the Program. First, we will be increasing our efforts in decontamination and decommissioning (D&D) older facilities that have been in existence since the start of the Program in the early 1950's. We have an estimated $7.4 billion in environmental liabilities requiring D&D efforts—about half of these facilities are no longer in use. The Program's positive track record on environmental safety is of the utmost importance to me, and is a core part of the Program's mission. This year's funding request will enable us to reduce these outstanding liabilities and ultimately reduce our caretaking burden. The second focus area is recapitalizing our Naval Nuclear Laboratory facilities and infrastructure systems, many of which have supported the Program since its inception over 60 years ago. Maintaining these laboratory facilities directly support nuclear fleet operations and advanced research and development efforts that make our nuclear navy the finest in the world.

I want to assure the committee that the planning efforts we execute in budgeting for current and future projects are done with extreme rigor. Our budget profile never deviates far from projections in earlier Future Years Nuclear Security Plan submissions. Investments we make today in research and development efforts not only advance capabilities, but will result in cost savings far into the future. In developing our request, I worked closely with the leadership of the National Nuclear Security Administration (NNSA), the DOE, Office of Management and Budget, and the Department of Defense (DOD). This budget not only reflects my priorities for Naval

Reactors but also integrates them with the other important work of my colleagues at NNSA and DOD. There is clear recognition of the valuable capabilities Naval Reactors provides and our history in effectively meeting our obligations. I understand the difficult budget environment in which Congress must craft legislation and I respectfully urge your support for aligning allocations with the fiscal year 2019 budget request.

Senator FISCHER. Thank you.

Mr. Trimble will give a statement on behalf of GAO. 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.

The critical missions of the Department of Energy depend on the extraordinary capabilities found at the Department and its networks of laboratories and production facilities across the country. These capabilities serve all of DOE missions, including weapons cleanup, nonproliferation, energy, and science.

To successfully execute these missions, DOE must maintain, rebuild, and renew both its physical and human capital. DOE's efforts, however, are hindered by longstanding management challenges that have been well documented in reports by Augustine-Mies, Krenold, the Academies, the DOE IG [Department of Energy Inspector General], and GAO. Given the growing fiscal and budgetary pressures facing the government, DOE can no longer afford to poorly manage these billion dollar programs.

My testimony today will highlight some of the challenges facing DOE, including the affordability of NNSA's nuclear modernization programs, the growing cost of DOE's environmental liabilities, management challenges in the nonproliferation program, and DOE's efforts to improve its management of programs, projects, and contracts.

Regarding weapons, NNSA faces challenges with the affordability and execution of its nuclear modernization programs, which include ongoing and planned LEPs [Life Extension Programs], as well as major modernization projects. Our review of the fiscal year 2017 SSMP [Stockpile Stewardship and Management Plan] found misalignment between NNSA's plans and projected budgetary resources which could make it difficult for NNSA to afford its planned portfolio of modernization programs. We found that NNSA's estimates of program costs exceeded the projected budgetary resources included in the President's planned near- and long-term modernization budgets. As NNSA updates its requirements and plans to respond to the new Nuclear Posture Review, NNSA will need to ensure that its updated modernization plans are aligned with its potential future budgets.

In addition, it is important to remember that the nuclear security enterprise is an interdependent system, and changes in one area can resonate throughout the enterprise. As you may recall, the 2014 Augustine-Mies report found that the lack of a stable, executable plan for modernization was a fundamental weakness for NNSA.

Regarding environmental cleanup, DOE's growing environmental liabilities demonstrate the need for DOE to improve its oversight

and management of its cleanup mission. In 2017, we added the Federal Government's environmental liabilities to our high risk list. DOE is responsible for about $384 billion of the $465 billion, and DOE's total cleanup liability has been growing. Over a recent 6-year period, EM spent $35 billion on cleanup while its liabilities grew by $90 billion. I should also note that these liability estimates do not include all of DOE's future cleanup responsibilities.

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 nonproliferation, DNN [Defense Nuclear Non-proliferation] has not consistently used program management leading practices. We found that DNN's policy did not require programs to establish life cycle estimates or measure performance against schedule and cost baselines. In addition, we have found that DNN's R&D [Research and Development] results were not being tracked consistently to help evaluate the success of that program.

To successfully meet the challenges facing it, DOE needs to improve its management of programs, projects, and contracts, areas that have been on GAO's high risk list for almost 3 decades. In recent years, DOE has taken some important steps, including requiring the development of cost estimates in accordance with industry best practices, creating new oversight structures, and ensuring that major projects, designs, and technologies are sufficiently mature before construction.

However, significant challenges remain.

First, DOE still lacks reliable enterprise-wide cost information. Without this information, meaningful cost analyses across programs, contractors, and sites are not possible. Reliable detailed data are also needed for DOE to manage its risk of fraud.

Second, DOE has not always followed its own requirements. In 2018, we found that NNSA's analysis of alternatives to address its need for enriched uranium showed a bias for one option, building a new enrichment facility. We have found a similar problem with what the AOA [Analysis of Alternatives] has done in other projects such as the low-activity waste pretreatment system at Hanford.

Third, regarding program management, we found in 2017 that the defense programs within NNSA had established program management requirements. However, for strategic commodities like uranium, plutonium, and tritium, these requirements are not always being met due to staff shortages. We also noted that DOE does not have a unified program management policy.

In closing, let me note that we have several ongoing engagements for this committee examining these management challenges, and we strongly support the oversight efforts of this committee.

Thank you. I would be happy to answer any questions you have.

[The prepared statement of Mr. Trimble follows:]

United States Government Accountability Office

Testimony

Before the Subcommittee on Strategic Forces, Committee on Armed Forces, 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-18-438T

GAO Highlights

Highlights of GAO-18-438T, a testimony before the Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate

March 14, 2018

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 works to decontaminate and decommission facilities 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 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. GAO also recently added the U.S. government's environmental liabilities to this list.

This statement is based on 18 GAO reports issued from October 2014 through February 2018 and discusses (1) challenges related to the affordability of NNSA's nuclear modernization plans; (2) challenges related to DOE's environmental liabilities; (3) the status of DOE's efforts to improve its management of contracts, projects, and programs; and (4) challenges facing NNSA's nonproliferation program. With NNSA documents, GAO updated its prior work on the affordability of NNSA's modernization plans.

What GAO Recommends

GAO is not making any new recommendations. GAO has suggested that Congress consider taking certain actions and that DOE continue to act on the numerous recommendations GAO has made to address these challenges.

View GAO-18-438T. 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. In April 2017, GAO found a misalignment between NNSA's modernization plans and the estimated budgetary resources needed to carry out those plans. Specifically, 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 (fiscal years 2018 through 2021) and long-term (fiscal years 2022 through 2026) modernization budgets. GAO also found that the costs of some major modernization programs—such as for nuclear weapon refurbishments—may also increase and further strain future modernization budgets. 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 also faces challenges with addressing its environmental liabilities—the total cost of its cleanup responsibilities. According to the *Fiscal Year 2017 Financial Report of the United States Government*, DOE is responsible for $383.8 billion—about 83 percent—of the federal government's $464.5 billion total reported environmental liability. GAO and other organizations have reported that DOE has not consistently taken a risk-informed approach to decision making for environmental cleanup, which could reduce costs while also reducing environmental risks more quickly. For example, in May 2017, we found that DOE may be able to save tens of billions of dollars and accelerate its waste treatment mission by reconsidering its approach for treating a portion of tank waste at DOE's Hanford Site in Washington State. Since 1994, GAO has made at least 30 recommendations to DOE and other federal agencies, which could reduce long-term costs and environmental risks more quickly. Of these, 15 remain unimplemented.

DOE has taken several important steps that demonstrate its commitment to improving contract and project management, but challenges persist. Specifically, DOE's revised project management order, issued in May 2016, made several changes in response to recommendations GAO made in prior years, such as recommending that projects develop cost estimates and analyses of alternatives according to GAO's best practices. However, DOE's recent efforts do not address several areas, such as acquisition planning for major contracts and aspects of program and project management with which the department continues to struggle. GAO has made several recommendations related to these areas, and DOE has generally agreed with most of them.

Finally, NNSA faces challenges in implementing its nonproliferation programs. For example, in September 2017, GAO found that selected programs in NNSA's Office of Defense Nuclear Nonproliferation (DNN) did not measure performance against schedule and cost baselines, as recommended by program management leading practices because DNN's program management policy did not require programs to measure performance in this way. GAO recommended that DNN revise its policy to require programs to measure performance against cost and schedule baselines. NNSA indicated it plans to take action to revise its policy.

Chairman 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's (DOE) National Nuclear Security Administration (NNSA) and Office of Environmental Management (EM).[1] NNSA is responsible for managing the nation's three 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. In support of these missions, in November 2017, NNSA issued its *Stockpile Stewardship and Management Plan*, which included about $10 billion for weapons activities for fiscal year 2018. More recently, NNSA's February 2019 budget justification for the Weapons Activities appropriations account requested about $61 billion for fiscal years 2019 through 2023 to carry out its mission, including its weapons modernization plans.

In support of its missions, NNSA implements a range of nonproliferation programs under its Office of Defense Nuclear Nonproliferation.[2] These programs include efforts to secure, consolidate, and dispose of weapons-usable nuclear materials and radiological sources;[3] reduce the risks of nuclear smuggling; enhance international export controls and International Atomic Energy Agency nuclear safeguards;[4] and support research and development of new nonproliferation technologies.

[1]NNSA is a separately organized agency within DOE. It was created under Title 32 of the National Defense Authorization Act for Fiscal Year 2000, Pub. L. No. 106-65, §§ 3201-3299, 113 Stat. 512, 953-971 (1999) (codified as amended at 50 U.S.C. §§ 2401-2484 (2017)).

[2]DOE defines a program as an organized set of activities directed toward a common purpose or goal in support of an assigned mission area.

[3]Weapons-usable nuclear materials are highly enriched uranium, uranium-233, and any plutonium containing less than 80 percent of the isotope plutonium-238. Such materials are also often referred to as fissile materials or strategic special nuclear materials.

[4]The International Atomic Energy Agency is an independent international organization based in Vienna, Austria, that is affiliated with the United Nations and has the dual mission of promoting the peaceful uses of nuclear energy and verifying that nuclear material subject to safeguards is not diverted to weapons development efforts or other proscribed purposes. Safeguards allow the agency to independently verify that nuclear material and other specified items are not diverted by, among other things, inspecting all facilities and locations containing nuclear material declared by countries to verify its peaceful use.

EM is responsible for decontaminating and decommissioning nuclear facilities and sites that are contaminated from decades of nuclear weapons production and nuclear energy research. In February 2017, we reported that since its inception in 1989, EM has spent more than $164 billion on cleanup efforts, which include retrieving, treating, and disposing of nuclear waste.[5]

Both NNSA and EM face critical challenges in fulfilling their missions. Since the end of the Cold War, key portions of the nuclear security enterprise's weapons production infrastructure have become outdated, prompting congressional and executive branch decision makers to call on DOE to develop plans to modernize this infrastructure.[6] Most recently, in January 2017, the President directed the Secretary of Defense to initiate a new *Nuclear Posture Review* to ensure that the U.S. nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st-century threats and reassure our allies. This review was released in February 2018.[7] Previously, the 2010 *Nuclear Posture Review* had 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.[8]

As NNSA works to modernize the nuclear security enterprise, EM must address the legacy of 70 years of nuclear weapons production and 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 contaminated thousands of sites and facilities, including land, buildings, other structures, and systems and equipment. Various federal laws, agreements with states, and court decisions require the federal

[5]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).

[6]The end of the Cold War caused a dramatic shift in how the United States approaches nuclear weapons. Instead of designing, testing, and producing new nuclear weapons, U.S. strategy shifted to maintaining the existing nuclear weapons stockpile indefinitely.

[7]Department of Defense, *Nuclear Posture Review* (Washington, D.C.: Feb. 2018). The Nuclear Posture Review establishes the nation's nuclear weapons requirements and policy.

[8]Department of Defense, *Nuclear Posture Review Report* (Washington, D.C.: Apr. 6, 2010).

government to clean up environmental hazards at federal sites and facilities, such as nuclear weapons production facilities. DOE's approach to addressing these environmental liabilities is 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.

DOE relies primarily on contractors to carry out its programs, and it is the largest civilian contracting agency in the federal government. In fiscal year 2017, it spent approximately 90 percent of its $32 billion in annual funding on contracts and major capital asset projects.[9] 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. In our 2017 High Risk List 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.[10] However, we also found that DOE still needed to make progress on the other four criteria for removal: organizational capacity, corrective action planning, monitoring effectiveness, and demonstrating progress.

Further, in our 2017 High Risk List update, we added the federal government's environmental liabilities to our High Risk List. DOE is responsible for more than 80 percent of reported federal environmental liabilities.[11] In our 2017 High Risk List 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.

[9]Major capital asset projects are projects estimated to cost $750 million or more. DOE defines a capital asset project as a project with defined start and end points required in the acquisition of capital assets.

[10]GAO-17-317. 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.

[11]GAO-17-317.

My testimony today discusses (1) challenges related to the affordability of NNSA's nuclear weapons modernization plans; (2) challenges in addressing DOE's environmental liabilities; (3) the status of DOE's efforts to improve its management of contracts, projects, and programs; and (4) challenges facing NNSA's nonproliferation program. My statement is based primarily on our work from 18 GAO reports issued from October 2014 through February 2018—including 7 reports issued since I testified on this issue in May 2017 (see the end of this testimony for a list of related reports).[12] Detailed information about the scope and methodology we used to conduct our prior work can be found in each of our issued reports. With information from the *Fiscal Year 2018 Stockpile Stewardship Management Plan* and the *2018 Nuclear Posture Review,* we updated our prior work on the affordability of NNSA's modernization plans. We provided new information to NNSA for review and incorporated one technical comment. 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.

[12]GAO, *Department of Energy: Continued Actions Needed to Address Management Challenges*, GAO-17-651T (Washington, D.C.: May 24, 2017).

Misalignment between NNSA's Modernization Budget Estimates and Plans Presents Challenges Raised by Affordability Concerns

Based on our prior work, NNSA faces challenges in the face of affordability concerns. In our past reports on NNSA's 25-year plans to modernize the nation's nuclear weapons stockpile and its supporting infrastructure, we have identified concerns regarding the alignment of NNSA's plans with budget estimates as presented in NNSA's annual Stockpile Stewardship and Management plans.[13] For example, in April 2017, we issued our most recent report on the *Fiscal Year 2017 Stockpile Stewardship and Management Plan,* in which 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's ability to afford its planned portfolio of modernization programs.[14] First, we found that NNSA's estimates of the 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 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, we found that the costs of some major modernization programs—such as for nuclear weapon refurbishments—may also increase and further strain future modernization budgets.

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

[13]The Stockpile Stewardship and Management Plan is updated annually and is NNSA's formal means of communicating to Congress information on modernization and operations plans and budget estimates over the next 25 years.

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

deferring the start of or canceling specific modernization programs) that 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.

It does not appear that NNSA has taken steps to address our recommendation or address questions regarding the affordability of its modernization plans. Notably, the *Fiscal Year 2018 Stockpile Stewardship Management Plan* was released in November 2017, but NNSA did not assess the affordability of the plan, and the fiscal year 2018 plan did not include the long-term projections of the President's budget for modernization, which help provide insights on the affordability of the plans. The *Fiscal Year 2018 Stockpile Stewardship Management Plan* stated that no policy decision had been made on the topline budget totals for NNSA's modernization efforts beyond fiscal year 2018. However, the plan indicated that these totals would be refined for the fiscal year 2019 budget in accordance with the National Security Strategy, National Defense Strategy, and the *Nuclear Posture Review*, which were under development at the time of the fiscal year 2018 plan's release.

In February 2018, the Department of Defense released the *Nuclear Posture Review,* which proposed a range of nuclear policy proposals, including initiatives to support NNSA's nuclear weapon infrastructure and workforce, accelerating one warhead replacement program, and developing two new nuclear weapon capabilities, including modifying a small number of existing warheads on submarine launched ballistic missiles to provide a low-yield option and pursuing a nuclear-armed sea-launched cruise missile. NNSA's fiscal year 2019 budget request for the Weapons Activities appropriations account proposes a 19 percent increase for nuclear modernization programs from the fiscal year 2017 enacted budget and states that the budget is consistent with the *Nuclear Posture Review.* However, the budget request notes that the *Nuclear Posture Review*'s policy initiatives need to be translated into requirements and that the options for meeting some *Nuclear Posture Review* goals—such as the low-yield submarine launched ballistic missile warhead—have not yet been developed. As a result, it is not clear whether the fiscal year 2019 budget estimates for NNSA's modernization programs are aligned with a changing set of modernization requirements. We are currently reviewing NNSA's *Fiscal Year 2018 Stockpile Stewardship and*

Management Plan, and we expect to conduct a review of the *Fiscal Year 2019 Stockpile Stewardship and Management Plan* after it is released.[15]

In its November 2014 report, the Augustine-Mies Panel observed that NNSA's Stockpile Stewardship Management Plans, which are intended to communicate long-range plans and cost estimates, have varied from year to year in the costs and schedules for the delivery of several major life extension programs and nuclear facilities.[16] The panel concluded that the lack of a stable, executable plan for modernization is a fundamental weakness for NNSA. As NNSA considers new modernization plans and programs as the 2018 *Nuclear Posture Review*'s policy initiatives are translated into requirements and options, aligning its modernization needs with potential future budgets will continue to be important.

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

DOE also faces challenges with addressing its environmental liabilities and its cleanup mission. In February 2017, we added the federal government's environmental liabilities to our High Risk List.[17] Specifically, we found that the federal government's environmental liabilities have been growing for the past 20 years and are likely to continue to increase. According to the *Fiscal Year 2017 Financial Report of the United States Government,* DOE's environmental liabilities estimate had increased to $383.8 billion—which is about 83 percent of the $464.5 billion of the federal government's total reported environmental liability. Notably, these estimates do not reflect all of the future cleanup responsibilities that DOE

[15]The National Defense Authorization Act for Fiscal Year 2013 includes a provision that we annually review a joint DOE-DOD report that addresses, among other things, the plan for the nuclear weapons stockpile and its delivery systems.

[16]Mr. Norman R. Augustine and Admiral Richard W. Mies served as the Co-Chairmen of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise (known as the "Augustine-Mies Panel"). Section 3166 of the National Defense Authorization Act for Fiscal Year 2013 established the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise and tasked the advisory panel with offering a recommendation "with respect to the most appropriate governance structure, mission, and management of the nuclear security enterprise." The panel's November 2014 report summarizes the panel's findings on the current health of the enterprise, examines the root causes of its governance challenges, and offers its recommendations to address the identified problems.

[17]GAO-17-317.

may face.[18] In addition, as discussed below, 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.

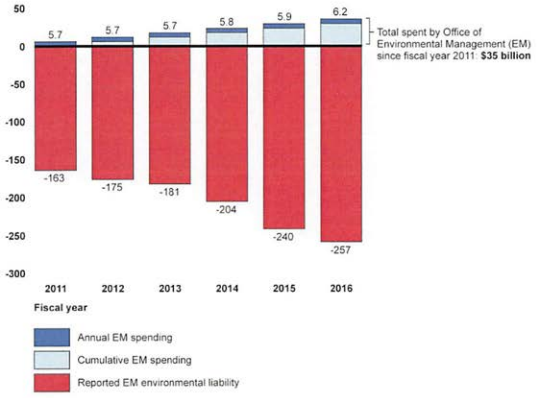
As we have previously reported, DOE's total reported environmental liabilities have generally increased over time.[19] Since 1989, EM has spent more than $164 billion to retrieve, treat, and dispose of nuclear and hazardous waste and, as of 2017, it had completed cleanup at 91 of 107 sites across the country (the 91 sites were generally viewed by DOE as the smallest and least contaminated sites to address). Even with billions spent on environmental cleanup, DOE's estimated environmental liability has roughly doubled from $176 billion in fiscal year 1997 to $383.8 billion in fiscal year 2017.[20] From 2011 through 2016, EM spent $35 billion, primarily to treat and dispose of nuclear and hazardous waste and construct capital asset projects to treat the waste (see fig. 1 for EM's annual spending and growing environmental liability). According to documents related to DOE's fiscal year 2016 financial statements, half of DOE's environmental liability resides at two cleanup sites: the Hanford Site in Washington State and the Savannah River Site in South Carolina.

[18]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.

[19]GAO-17-317.

[20]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.

Figure 1: 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-18-438T

Notes: 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.

We also reported in February 2017 that DOE's estimated liability does not include billions in expected costs.[21] 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.[22] Examples of costs we reported on that DOE could not 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 this estimate is highly uncertain. In 2010, DOE terminated its efforts to license a repository at Yucca Mountain near Las Vegas, Nevada. In 2013, DOE proposed a repository at a different location and in 2015 proposed separate repositories for defense and commercial waste. We reported in October 2014 that estimated future costs for any repository become more uncertain with each year of delay.[23] We also reported in January 2017 that DOE's cost estimates for its 2015 proposal were uncertain and excluded billions of dollars in estimated costs.[24] In April 2017, we reported that using a comprehensive assessment of the benefits, costs, and schedules to inform DOE's waste disposal plan may show

[21]GAO-17-317.

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

[23]GAO, *Spent Nuclear Fuel Management: Outreach Needed to Help Gain Public Acceptance for Federal Activities That Address Liability*, GAO-15-141 (Washington, D.C.: Oct. 9, 2014).

[24]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).

that tens of billions of dollars could be saved if DOE reverted to its original plan to have a single repository for defense and commercial nuclear waste.[25] In June 2017, a bill to renew efforts to open the Yucca Mountain repository was introduced in the House of Representatives.[26] Further, the President's budget requests for fiscal years 2018 and 2019 proposed resuming the license application process for the repository at Yucca Mountain, but Congress has not yet funded these DOE activities.

In addition, according to the DOE Inspector General, DOE may have insufficient controls in place to accurately account for its environmental liabilities. In November 2016, the DOE Inspector General reported a significant deficiency in internal controls related to the reconciliation of environmental liabilities.[27]

Moreover, DOE has not consistently taken a risk-informed decision-making approach to its environmental cleanup mission to more efficiently use resources. As our reports and those by other organizations 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. As we discuss below, we and others have pointed out that DOE needs to take a nationwide, risk-based approach to cleaning up these sites, which could reduce costs while also reducing environmental risks more quickly.

- In May 2017, we reported on DOE's efforts to treat a significant portion of the waste in underground tanks at the Hanford Site.[28] We found that DOE chose different approaches to treat the less radioactive portion of its tank waste—which DOE refers to as "low-

[25]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).

[26]Nuclear Waste Policy Amendments Act of 2017, H.R. 3053, 115th Cong. (2017).

[27]U.S. Department of Energy, Office of the Inspector General, *The Department of Energy's Fiscal Year 2016 Consolidated Financial Statements*, OAI-FS-17-02 (Washington, D.C.: Nov. 15, 2016).

[28]Our report focused on "low-activity waste," which is DOE's term for the portion of tank waste with low levels of radioactivity. DOE estimates that low-activity waste contains less than 10 percent of the radioactivity of the tank waste but more than 90 percent of the tank waste by volume. 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).

activity waste" (LAW)—at the Hanford and Savannah River sites.[29] 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 experts who attended a meeting we convened with 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.[30] DOE agreed with both recommendations.[31]

- In 2015, a review organized by the Consortium for Risk Evaluation with Stakeholder Participation reported that DOE was not optimally

[29]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 yet treated any of Hanford's LAW and faces significant unresolved technical challenges in doing so. Grout immobilizes waste in a concrete-like mixture. Vitrification immobilizes waste in glass.

[30]We are currently in the process of completing a report on DOE's Waste Treatment and Immobilization Plant quality assurance program.

[31]The National Defense Authorization Act for Fiscal Year 2017, section 3134, requires the Secretary of Energy to enter into an arrangement with a federally funded research and development center to conduct an analysis of approaches for treating Hanford's supplemental LAW, as well as concurrently enter into an arrangement with the National Academies of Sciences, Engineering, and Medicine to conduct a review of the analysis conducted by the federally funded research and development center. The National Academies is currently reviewing an analysis being carried out by a federally funded research and development center on approaches for treating supplemental LAW at the Hanford Site. Specifically, the National Academies plans to evaluate the technical quality and completeness of the analysis, such as the methods used to conduct risk, cost-benefit, schedule, and regulatory compliance assessments and the results of the assessments. The National Academies is also currently conducting a second assessment of EM's technology development efforts, including technologies and/or alternative approaches that could reduce EM's long-term costs, accelerate schedules, or mitigate risks.

using available resources to reduce risk.[32] 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 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.[33] For example, the National Research Council noted that the current regulatory structure for LAW is based primarily on the 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.

Since 1994, we have made at least 30 recommendations related to addressing the federal government's environmental liability to DOE and others and 4 suggestions to Congress to consider changes to the laws governing cleanup activities. Of these, 15 recommendations remain unimplemented. If implemented, these recommendations would improve the completeness and reliability of the estimated costs of future federal cleanup responsibilities and lead to more risk-based management of the cleanup work.[34] We believe these recommendations are as relevant, if not more so, today.

[32]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. Omnibus Risk Review Committee, *A Review of the Use of Risk-Informed Management in the Cleanup Program for Former Defense Nuclear Sites* (August 2015).

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

[34]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.

DOE Has Taken Steps to Improve Management of Contracts, Projects, and Programs, but Challenges Remain

The Secretary of Energy has taken several important steps that demonstrate DOE's commitment to improving the management of contracts, projects, and programs. However, our recent work indicates that, even with these efforts, NNSA and EM continue to face long-standing challenges in several areas.

DOE Has Made Progress in Managing Contracts and Projects

As we noted in our 2017 High Risk List update, DOE has made progress in its contract and project management. DOE continued to meet the criterion for demonstrating a strong commitment and top leadership support for improving project management.[35] The Secretary of Energy issued two memorandums, in December 2014 and June 2015, that lay out a series of changes to policies and procedures to improve project management. These changes were included in DOE's revised project management order, DOE Order 413.3B, issued in May 2016. As noted in the memorandums, some of these changes are in response to recommendations we made in prior years, such as recommending that projects develop cost estimates and analyses of alternatives according to our best practices.

DOE also made significant efforts to improve its performance in monitoring and independently validating the effectiveness and sustainability of corrective measures and now partially meets our monitoring criterion for removing agencies and program areas from our High Risk List. For example, the Secretary improved the department's senior-level monitoring capability and 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

[35]GAO-17-317.

across DOE and advise DOE senior leaders on cost, schedule, and technical issues for projects.[36]

Challenges Persist in Several Areas

We have previously reported that DOE's recent efforts do not address several areas where it continues to have challenges, including (1) acquisition planning for its major contracts, (2) the quality of enterprise-wide cost information available to DOE managers and key stakeholders, (3) program and project management, and (4) major legacy projects.

Acquisition Planning for Major Contracts

As we have previously reported, during the acquisition planning phase for contracts, DOE makes critical decisions that have significant implications for the cost and overall success of an acquisition. The size and duration of DOE's management and operating (M&O) contracts[37]—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. In August 2016, we examined DOE's use of M&O contracts.[38] According to DOE officials we interviewed at that time, one of the primary reasons DOE uses M&O contracts is because they are easier to manage with fewer DOE personnel because they are less frequently competed and have broadly written scopes of work, among other attributes. We found that DOE did not consider acquisition alternatives beyond continuing its long-standing 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

[36]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 on the availability of reliable enterprise-wide cost information on which to base oversight activities. See GAO-17-317.

[37]M&O contracts are agreements under which the government contracts for the operation, maintenance, or support, on its behalf, of a government-owned or government-controlled research, development, special production, or testing establishment wholly or principally devoted to one or more of the major programs of the contracting federal agency. 48 C.F.R. § 17.601 (2018).

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

and form of contract, raising risks for both contract cost and performance. We recommended in our August 2016 report that DOE establish a process to analyze and apply its experience with contracting alternatives. DOE generally concurred with our recommendation and in November 2016 issued updated guidance that acquisition planning documents are to contain a thorough discussion of alternatives beyond simply extending or competing M&O contracts.[39]

Quality of Enterprise-Wide Cost Information

We have previously reported that the effectiveness of DOE's monitoring of its contracts, projects, and programs depends on the availability of reliable enterprise-wide cost 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, we have found that meaningful cost analyses across programs, contractors, and sites are not usually 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 January 2017 that this plan did not provide a useful road map for guiding NNSA's efforts.[40] For example, we found that 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 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

[39]We currently have four ongoing reviews related to contract management, including (1) performance management of DOE's management and operating contracts, (2) DOE and NNSA's subcontractor management, (3) NNSA's contract document management, and (4) NNSA's support service contracts.

[40]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).

recommendation. We are monitoring implementation of this recommendation.[41]

In addition, as we have previously noted, DOE needs quality data 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.[42] In a 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.[43] We found that 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. According to DOE, the recommendation establishes agency-specific requirements for DOE contractors that are more prescriptive than current federal requirements, and its M&O contractors, not DOE, are responsible for performing data analytics and determining what data are needed to do so. DOE's response to our recommendation is concerning because it demonstrates that DOE does not fully appreciate its responsibility for overseeing contractor costs. We 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 applying data analytics depends on the availability of

[41]Senate Report 115-125, accompanying S. 1519, the National Defense Authorization Act for 2018, includes a provision for us to examine NNSA's financial integration efforts, and we have initiated this work.

[42]Data analytics enable an organization to analyze transactional data to obtain insights into the operating effectiveness of internal controls and to identify improper cost charges, potential indicators of fraud, or actual fraudulent payments or activities.

[43]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).

complete and sufficiently detailed contractor data. Therefore, by implementing our recommendation, DOE could take the important steps necessary to require that contractors maintain sufficiently detailed transaction-level cost data that are reconcilable with amounts charged to the government.

Program and Project Management

Although, as mentioned previously, DOE has taken some steps to improve program and project management, our recent work has shown that DOE continues to face several challenges in these areas, including the following:

- In February 2018,[44] we found that NNSA's preliminary plan for analyzing options to supply unobligated low-enriched uranium (LEU) for various missions, including certain national security needs, is inconsistent with DOE directives for program and project management that state that mission need should be independent of and not defined by a particular solution.[45] For example, NNSA's analysis of alternatives showed preference toward a particular solution—building a new uranium enrichment capability—and the agency has not included other technology options for analysis. Moreover, NNSA has prepared preliminary cost estimates for two uranium enrichment technology options—large and small centrifuges—that the agency considers to be the most feasible. However, these estimates are limited in scope and do not fully meet best practices for reliable cost estimates. We recommended that NNSA revise its mission need statement and adjust the range of options it considers in the analysis of alternatives process and that NNSA ensure its cost estimates are consistent with best practices. NNSA neither agreed nor disagreed with our recommendations and stated that it will take future actions consistent with these recommendations.

[44]GAO, *Nuclear Weapons: NNSA Should Clarify Long-Term Uranium Enrichment Mission Needs and Improve Technology Cost Estimates*, GAO-18-126 (Washington, D.C.: Feb. 16, 2018).

[45]NNSA has several mission needs for enriched uranium, including providing LEU to fuel a nuclear reactor that produces tritium—a key isotope used in nuclear weapons. NNSA has a pressing defense need for unobligated LEU to fuel this reactor, meaning the uranium, technology and equipment used to produce the LEU, must be U.S. in origin. Because the United States lost its only source of unobligated LEU production in 2013, the supply is finite.

- In a January 2018 report, we found management challenges associated with NNSA's life extension programs (LEP).[46] For example, we found that NNSA had begun implementing requirements for using earned value management (EVM)[47]—a tool used across industry and government for conducting cost and schedule performance analysis—in three LEPs, but it had not adopted a key best practice that could help the agency better manage risk for LEPs. Specifically, we found that NNSA does not require an independent team to validate the EVM systems used by NNSA's contractors for LEPs against the national EVM standard. We concluded that without requiring validation of EVM systems, NNSA may not have assurance that its LEPs are obtaining reliable EVM data for managing their programs and reporting their status. We recommended that NNSA require an independent team to validate contractor EVM systems used for LEPs. NNSA agreed with our recommendation but stated that it already relies on a DOE project management office to independently validate contractor EVM systems. However, as we reported, DOE has not independently validated contractor EVM systems at six of the seven contractor sites that are responsible for conducting LEP activities.
- In November 2017, we found that NNSA had established program management requirements, such as developing cost and schedule estimates for its uranium, plutonium, tritium, and lithium programs and had established managers' roles and responsibilities for these programs.[48] However, officials told us that the programs had not fully met these requirements primarily because of staff shortages. We recommended that NNSA determine the critical staff skills it will need for these programs and use that information to address staffing shortages. NNSA agreed with our recommendation.
- In our September 2017 report on NNSA's Plutonium Disposition Program, we found that DOE does not have sufficient space at the Waste Isolation Pilot Plant (WIPP) to dispose of all defense

[46]GAO, *Nuclear Weapons: NNSA Should Adopt Additional Best Practices to Better Manage Risk for Life Extension Programs*, GAO-18-129 (Washington, D.C.: Jan. 30, 2018).

[47]EVM measures the value of work accomplished in a given period and compares it with the planned value of work scheduled for that period and the actual cost of work accomplished.

[48]GAO, *Nuclear Weapons: NNSA Needs to Determine Critical Skills and Competencies for Its Strategic Materials Programs*, GAO-18-99 (Washington, D.C.: Nov. 14, 2017).

transuranic waste.[49] Moreover, DOE officials recognize that expansion of WIPP's disposal space may be necessary in the future, but they had not analyzed or planned for the facility's expansion because their focus has been on resuming operations at WIPP, which had been suspended in 2014 after two separate accidents at the facility. Without developing a plan for WIPP that includes an integrated schedule for completing a regulatory approval process and constructing new space before WIPP's existing space is full, DOE does not have reasonable assurance that it will be able to expand the repository in a timely manner. We made four recommendations, including that DOE develop a plan for expanding WIPP's disposal space that includes a schedule for completing the expansion before existing space is full. DOE concurred with our recommendations.

- In September 2017, we found that DOE's program to re-establish the production of a plutonium isotope used to provide electrical power for National Aeronautics and Space Administration missions had made progress but faced a number of challenges to meeting production goals.[50] Specifically, we found that DOE had not developed an implementation plan that identifies milestones and interim steps that can be used to demonstrate progress in meeting production goals. Our prior work has shown that plans that include milestones and interim steps help an agency to set priorities, use resources efficiently, and monitor progress in achieving agency goals. In our September 2017 report, we made three recommendations, including that DOE develop such a plan for its plutonium isotope production approach and that DOE assess the long-term effects of known production challenges and communicate these effects to the National Aeronautics and Space Administration. DOE concurred with our recommendations.
- In a September 2017 report on NNSA's uranium program, we found that NNSA had not developed a complete scope of work, a life-cycle cost estimate, or an integrated master schedule for the overall uranium program—all of which are considered leading practices—and

[49]GAO, *Plutonium Disposition: Proposed Dilute and Dispose Approach Highlights Need for More Work at the Waste Isolation Pilot Plant*, GAO-17-390 (Washington, D.C.: Sept. 5, 2017). WIPP is an underground repository for the disposal of transuranic nuclear waste, which is waste contaminated by nuclear elements heavier than uranium, such as diluted plutonium.

[50]GAO, *Space Exploration: DOE Could Improve Planning and Communication Related to Plutonium-238 and Radioisotope Power Systems Production Challenges*, GAO-17-673 (Washington, D.C.: Sept. 8, 2017).

that it had no time frame for doing so.[51] We reported that NNSA plans to do so for the specific Uranium Processing Facility project,[52] as required by DOE's project management order. However, NNSA had not developed a complete scope of work for key program requirements, including important and potentially costly repairs and upgrades to existing buildings in which NNSA intends to house some uranium processing capabilities. We concluded that because NNSA had not developed a complete scope of work for the overall uranium program, it did not have the basis to develop a life-cycle cost estimate or an integrated master schedule for the entire uranium program, which runs counter to best practices identified in GAO's cost estimating and scheduling guides. We recommended that NNSA set a time frame for completing the scope of work, life-cycle cost estimate, and integrated master schedule for the overall uranium program. NNSA generally agreed with this recommendation and stated that it has ongoing efforts to complete these actions.[53]

[51]GAO, *Modernizing the Nuclear Security Enterprise: A Complete Scope of Work Is Needed to Develop Timely Cost and Schedule Information for the Uranium Program*, GAO-17-577 (Washington, D.C.: Sept. 8, 2017). The scope of work reflects all activities as defined in the program's work breakdown structure, which defines in detail the work necessary to accomplish a project's objectives. A life-cycle cost estimate provides an exhaustive and structured accounting of all resources and associated cost elements required to develop, produce, deploy, and sustain a particular program. An integrated master schedule is a document that integrates the planned work, the resources necessary to accomplish that work, and the associated budget for a program, as called for in best practices.

[52]In 2004, NNSA initiated plans for the construction of a new Uranium Processing Facility, a facility that would consolidate some of its existing uranium processing facilities—which are located at the Y-12 National Security Complex in Oak Ridge, Tennessee, were built in the 1940s and 1950s, and are outdated and deteriorating—into a single, more modern facility.

[53]Senate Report 112-26 accompanying S. 1253, a bill for the National Defense Authorization Act for Fiscal Year 2012, includes a provision for us to review independent cost estimates of the Chemical and Metallurgical Research Replacement Nuclear Facility and the Uranium Processing Facility conducted by NNSA to ensure the accuracy of the cost estimates and that all cost savings measures have been considered. According to DOE's February 2018 monthly project portfolio status report, NNSA plans to release its final independent cost estimate report in late February 2018.

NNSA's Nonproliferation Program Faces Performance Measurement and Program Management Challenges

Our previous work has found that NNSA also faces challenges implementing its nonproliferation programs under its Office of Defense Nuclear Nonproliferation (DNN), which implements nuclear nonproliferation programs worldwide. 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. Specifically,

- In September 2017, we found that four DNN programs did not have schedule and cost estimates covering their planned life cycles and did not measure performance against schedule and cost baselines as is recommended by program management leading practices.[54] NNSA officials explained that this is due in part to high levels of uncertainty in planning the selected programs' work scope or schedules, particularly in working with partner countries. However, we noted that uncertainty should not prevent these programs from establishing more complete or longer-term estimates to account for the time and resources they need to achieve their goals and track their performance. In addition, we observed that DOE's cost estimating guide, which applies to NNSA programs, describes approaches for programs to incorporate risk and uncertainty in estimates. But we found that DNN's program management policy, which was updated in February 2017, did not outline requirements for programs to establish life-cycle estimates or measure performance against schedule and cost baselines. We recommended that DNN revise its program management policy to require DNN programs to follow life-cycle program management leading practices, such as requiring life-cycle estimates and measuring against baselines. Updating the DNN policy to include requirements and guidance on cost estimating and tracking performance against schedule and cost baselines could help ensure that NNSA managers and Congress have better information on (1) how much DNN programs may cost, (2) the time they may need to achieve their goals, and (3) how effectively they are being executed compared to plans. Although NNSA neither agreed nor disagreed with the recommendation, it indicated that it plans to take action to revise its policy to address the recommendation.

[54]GAO, *Nuclear Nonproliferation: NNSA Needs to Improve Its Program Management Policy and Practices*, GAO-17-773 (Washington, D.C.: Sept. 28, 2017). We reviewed four selected DNN programs: Nuclear Material Removal, Highly Enriched Uranium Reactor Conversion, Radiological Security, and International Nuclear Security.

- In February 2017, we found that NNSA was unable to demonstrate the full results of its research and development technology for preventing nuclear proliferation.[55] Specifically, we reported that DNN's Research and Development program did 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 was difficult to interpret because the program's performance measures did not define criteria or provide context justifying how the program determined that it met its targets. We concluded that this, in turn, could hinder users' ability to determine the program's progress. NNSA officials said that final project reports did not document their assessment of performance against baseline targets and that there was 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. We also concluded that more consistently tracking and documenting the transitioned and deployed technologies that result from DNN's projects could facilitate knowledge sharing within DNN. This would also 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.
- In June 2016, we found that the Nuclear Smuggling Detection and Deterrence (NSDD) program had developed a program plan but that the plan did not include measurable goals and performance measures aligned to the goals.[56] As a result, we concluded that the NSDD program may not be able to determine when it has fully accomplished its mission, and it risked continuing to deploy equipment past the point

[55]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.

[56]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.: June 17, 2016).

of diminishing returns. 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. NNSA agreed with this recommendation, and in February 2017, NSDD issued a revised program plan. As a result of NNSA's implementation of this recommendation, Congress and NNSA decision makers will have additional information to assess the status, benefits, and performance of the NSDD program.

Chairman 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 Jonathan Gill, Assistant Director; Antoinette Capaccio; Ricki Gaber; William Hoehn; and Amanda Kolling.

Related GAO Products

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

Nuclear Weapons: NNSA Should Clarify Long-Term Uranium Enrichment Mission Needs and Improve Technology Cost Estimates. GAO-18-126. Washington, D.C.: February 16, 2018.

Nuclear Weapons: NNSA Should Adopt Additional Best Practices to Better Manage Risk for Life Extension Programs. GAO-18-129. Washington, D.C.: January 30, 2018.

Nuclear Weapons: NNSA Needs to Determine Critical Skills and Competencies for Its Strategic Materials Programs. GAO-18-99. Washington, D.C.: November 14, 2017.

Nuclear Nonproliferation: NNSA Needs to Improve Its Program Management Policy and Practices. GAO-17-773. Washington, D.C.: September 28, 2017.

Modernizing the Nuclear Security Enterprise: A Complete Scope of Work Is Needed to Develop Timely Cost and Schedule Information for the Uranium Program. GAO-17-577. Washington, D.C.: September 8, 2017.

Space Exploration: DOE Could Improve Planning and Communication Related to Plutonium-238 and Radioisotope Power Systems Production Challenges. GAO-17-673. Washington, D.C.: September 8, 2017.

Plutonium Disposition: Proposed Dilute and Dispose Approach Highlights Need for More Work at the Waste Isolation Pilot Plant, GAO-17-390. Washington, D.C.: September 5, 2017.

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.

2017 Annual Report: Additional Opportunities to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits. GAO-17-491SP. Washington, D.C.: April 26, 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.

High-Risk Series: Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others. GAO-17-317. Washington, D.C.: February 15, 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.

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

Spent Nuclear Fuel Management: Outreach Needed to Help Gain Public Acceptance for Federal Activities That Address Liability. GAO-15-141. Washington, D.C.: October 9, 2014.

Senator FISCHER. Thank you, Mr. Trimble.

We are very pleased to have Senator Reed, the ranking member, with us today, and I would ask if you would like to begin our first round of questions, sir.

Senator REED. Thank you very much, Madam Chairwoman. I thank you not only for your gracious hospitality but for your outstanding leadership along with Senator Donnelly. So thank you again.

Madam Secretary, I would like to talk about pit production. This has been a saga going on for almost a decade now, and I have been involved with it in the committee. We started off with a big box concept at Los Alamos and Oak Ridge and discovered that was too

expensive. We shifted to a modular approach. That modular approach was agreed to by DOD, NNSA, and Congress in the 2014 National Defense Authorization Act. And yet, it seems to have resurfaced again as not a settled issue but one that is subject to debate. Senator McCain and I wrote a letter to the Secretary, both Secretary Perry and Secretary Mattis, about this issue.

I assume you are aware of all of this, the fact that we have assumed in the 2014 NDAA [National Defense Authorization Act] this was settled. You are aware of all of this I am sure.

Secretary GORDON-HAGERTY. Yes. I am generally aware of everything that you have cited.

Senator REED. Thank you.

You have just, because of this reopening of the issue, performed an analysis of alternatives. Your office has. Now, that analysis is being reviewed by an engineering contractor. Are you going to have this new analysis independently reviewed outside of NNSA since we will get a definitive answer we hope?

Secretary GORDON-HAGERTY. So the engineering analysis that is currently underway is in its final stages of preparation. And currently we have members from Los Alamos, Livermore, Savannah River, and also members of the former Rocky Flats Plant participating in this entire review. The assessment is the final draft data are available, and they are going to be reviewing the final draft data in the next week or so, at which point I have invited Under Secretary Lord from DOD over. When I receive the final draft briefing, we will take a look at it and then I will make my recommendation to the Deputy Secretary of Energy. We are trying to meet the NDAA guidelines direction of 11 May.

Senator REED. Since this is shaping up to be a battle of analysis, I would urge you to get an outside review also. And if you could commit to that, I would appreciate it. Please consider that.

Secretary GORDON-HAGERTY. I will consider that. Thank you.

Senator REED. According to the fiscal year 2018 National Defense Authorization Act, it requires NNSA to forward its recommendation to DOE, and they in turn must certify it meets their need. And you are a member of the Nuclear Weapons Council. Can you tell us and update what you said previously about the status of this review?

Secretary GORDON-HAGERTY. Yes. So in fact, I attended my first Nuclear Weapons Council meeting—I am a member of that august group—on my day 3 of my tenure. I found it to be very engaging and very enlightening.

With regard to the plutonium analysis of alternatives and the engineering analysis that is currently ongoing, we are required, as I mentioned, to have the results to the committee through the NDAA requirement by 11 May. And that is why we are working so quickly on making sure that the engineering analysis that was done by an independent architecture and engineering firm is providing us with those data. And we are doing a rigorous analysis, again, with Livermore, Los Alamos, and Savannah River site personnel, as well as our federal employees.

Senator REED. Thank you very much, Madam Secretary.

And gentlemen, thank you for your service.

Admiral Caldwell, good luck at Groton with the Colorado.

Admiral CALDWELL. Yes, sir. Thank you.

Senator REED. We are putting a new attack submarine in the water. He is, not me.

[Laughter.]

Senator REED. Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator.

Madam Secretary, as I mentioned in my opening statement, the Nuclear Posture Review repeatedly makes the point that we have not made sufficient progress towards a responsive nuclear infrastructure. When discussing NNSA's production of strategic materials, particularly plutonium and tritium, the NPR states that programs are planned but not yet fully funded to ease these critical production shortfalls.

I understand NNSA's fiscal year 2019 budget was written prior to the NPR's release. But does NNSA have a good understanding of the costs that are not reflected in the out-year projections submitted with this budget?

Secretary GORDON-HAGERTY. With regard to the fiscal year 2019 submission and related to the NPR, in near term we are leaning as far forward as we possibly can and to ensure, working closely with OMB [Office of Management and Budget] and DOD, that we have the priorities correct and that, again, with some congressional authorization that is needed for NNSA to move forward, we obtain that authorization so we can move as quickly as possible. In terms of out-years, we are going to be working on those budget requirements shortly.

Senator FISCHER. In terms of the out-years, can you give us some idea of the scale of investment that we are looking at here?

Secretary GORDON-HAGERTY. This is going to be a sustained, prolonged, and significant investment in our nuclear security enterprise. Significant. And the numbers I have heard are up to 6.5 percent of the DOD budget to support our initiatives long-term.

Senator FISCHER. Thank you.

As you know, the NPR declares the administration's intent to rapidly pursue Stockpile Responsiveness Program established by Congress, and this is something that I am very supportive of. When can we expect to see that program implemented?

Secretary GORDON-HAGERTY. We are already undertaking that program. We have some requests for that program in the fiscal year 2019 budget submission. And we will be taking that on. And I can provide you with a fuller explanation for the record.

[The information follows:]

Secretary GORDON-HAGERTY. The National Nuclear Security Administrations (NNSA) is already undertaking the Stockpile Responsiveness Program (SRP). The program is designed to provide a greater breadth of opportunities to exercise key capabilities and skills, the primary benefit of which is the preservation and transfer of knowledge across the workforce. It will take some time to develop the program and evaluate its proper size and scope in balance with our other programs.

NNSA's Fiscal Year 2019 budget requests for SRP address gaps that have been identified in exercising design capabilities to maintain resilience in the face of evolving threats and requirements identified in the Nuclear Posture Review. The budget request reflects a balance between maintaining readiness for future threats and the tempo required to execute those life extension programs that are going forward to meet known present requirements.

While we are looking at ways to improve NNSA's response time to meeting national needs, recommendations are made collaboratively with the Department of Defense through the Nuclear Weapons Council.

Senator FISCHER. And do you have in place a process so that you can evaluate the proposals that come from that?

Secretary GORDON-HAGERTY. Absolutely.

Senator FISCHER. Can you let us know, are you working with labs in order to establish that program? Can you give us a little more detail on it?

Secretary GORDON-HAGERTY. Sure. One of the things that I am committed to do, Madam Chairman, is absolutely working as a team. This is not a federal directive coming down to the labs' plants and sites. We are going to do whatever we can to communicate with, work with, and ensure that the laboratories and plants and sites that have to execute these missions are fully engaged with and have the opportunity to provide the input that is necessary for us to maintain a fulsome program. And it is impossible for us to do so from Washington.

So I have already had my first tri-lab meeting with the lab directors. I have already spoken with all my field office managers, all of the plants and site directors, and they understand that my commitments to them will be open communications, and it must be two-way so we can ensure that all of the requirements necessary to effect or to execute our missions are made with an engagement strategy of everyone from headquarters to the field.

Senator FISCHER. Thank you. I hope you will continue to keep Congress informed on that to make sure we are meeting the objectives that were laid out by Congress.

Secretary GORDON-HAGERTY. I will. Thank you.

Senator FISCHER. And as you note in your opening statement, more than half of NNSA's infrastructure is over 40 years old, and roughly 30 percent dates back to the Manhattan Project. Last year, the Congress directed NNSA to establish the infrastructure modernization initiative in order to reduce the backlog of deferred maintenance at least by 30 percent by 2025, and that is a detailed road map.

I understand that you are currently formulating a plan for how to execute this initiative. And when do you expect that plan to be completed so that you can brief Congress?

Secretary GORDON-HAGERTY. I was just briefed on that plan yesterday. And they are putting together the plan right now. I believe that we can probably have that plan to you by the end of this year.

Senator FISCHER. And have you established any kind of guidance or criteria for project consideration on that?

Secretary GORDON-HAGERTY. I understand that there is, but I am happy to get back to you with that response.

[The information follows:]

Secretary GORDON-HAGERTY. To prioritize projects within available resources, standardized processes have been implemented to rank annual recapitalization, disposition, and maintenance activities across the enterprise.

For example, NNSA uses a prioritization methodology that ranks investments to optimize risk reduction per dollar by evaluating key criteria for Recapitalization projects. Criteria evaluated include program requirements and risk reduction, safety risk reduction, increases in operational efficiency and/or productivity, and deferred maintenance reduction. Similarly, NNSA ranks excess facility disposition projects by evaluating risk reduction, cost effectiveness, and cost savings.

Currently, funding for Maintenance and Repair of Facilities is prioritized within an enterprise risk management framework based on mission needs, probability of failure of a system or a component, and risk determination with regard to safety,

security, and environmental requirements. Investments focus on structures, systems, and components that are considered essential to NNSA's national security missions. NNSA is transitioning to the BUILDER Sustainment Management System (which was developed by the U.S. Army Corps of Engineers) to capture and predict the physical condition of infrastructure over time. When fully implemented, BUILDER's standards and policies prioritization capabilities will be used to inform maintenance decisions across the NNSA enterprise. These BUILDER capabilities will allow NNSA to take less risk maintaining critical building systems (e.g., fire protection) and facilities than other less critical systems and facilities. BUILDER's standards and policies will be used to assist NNSA in assigning maintenance and replacement priorities to specific facilities and specific systems in those facilities as very high, high, medium, low, or no repair.

Additional information will be provided in NNSA's Infrastructure Modernization Initiative Implementation Plan, which will be available later this year.

Senator FISCHER. Thank you.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

And thank you to the witnesses for being here.

Secretary Gordon-Hagerty, if we include the low-yield warhead, we have upward of six major programs, all occurring at the same time, and this does not include modernizing your infrastructure. My understanding is they all merge at the Kansas City plant and at Pantex in Amarillo, Texas. What are you doing to address this?

Secretary GORDON-HAGERTY. Senator Donnelly, as I had mentioned, one of my priorities will be to ensure that we have active and open communications with not only the headquarters and federal field elements but, obviously, the teams that have to execute these missions. So in order to ensure that we have the capabilities, the infrastructure, the technical personnel, as well as the technicians and the support staff in order to be able to execute all of these missions on time, on budget, and within the parameters set forth by the Nuclear Weapons Council to ensure that our customer, the Department of Defense, has the needs and has the capabilities that they require for our nuclear deterrent, I am making sure that all of those teams will come together. I am certain that they have in the past, but there is a new administrator and she is going to ensure that that kind of robust organizational framework is put in place.

Senator DONNELLY. It is an awful lot of moving parts all at the same time —

Secretary GORDON-HAGERTY. I agree.

Senator DONNELLY.—all kind of coming to the same place at the same time as well. And so we just have to make sure we are on top of that.

Mr. Owendoff, what are you doing to begin removing the Hanford low-activity waste from the tanks, and when will you begin, and when do you hope to finish?

Mr. OWENDOFF. Thank you, Senator Donnelly.

We have a contract goal, and the Secretary is very committed to be able to start making glass by the end of December 2021. We have a consent decree milestone that says we need to have started by December of 2023. So we have some time. But we are working on the December 2021 date for low-activity.

We have felt, sir, that we need to start the first process building. There are three. We need to get the first one in place and running, and then work the next two, the high-level waste and the

pretreatment facilities. Those other two facilities have a consent decree date of 2033 and 2035 to be operational.

Senator DONNELLY. Thank you.

Admiral Caldwell, how much do you expect it will cost to complete the fuel examination facility at Idaho, and does that include the hot cells to handle the fuel?

Admiral CALDWELL. Yes, sir. Thanks for the question. And I would like to say up front, Chairman Fischer and Ranking Member Senator Donnelly, thanks for the support of this subcommittee. It has been very important to my program and my ability to deliver safe, reliable, and effective nuclear propulsion to the Navy.

Sir, regarding your question, there are multiple aspects and phases that I need to just walk you through quickly.

The first is the facility that we have in Idaho does three things for us. It receives spent fuel, allows us to handle it safely, and package it. We are capitalizing that capability with the spent fuel handling facility, which this subcommittee has supported. That facility will come on line initially in 2024 and then be fully operationally capable in 2025.

The second component that occurs out at the expended core facility is the examination of naval spent fuel. That is important because it allows us to assess how that fuel performed over life and then to make modifications to our future fuel systems, and the process that that has enabled us to deliver the life of the ship or be prepared to deliver the life of the ship core for Columbia.

That examination's recapitalization is one that I just defined the mission need for last year. And so we are coming our progression of alternatives and study to determine exactly what the requirements are and what the costs will be. And that will be reflected in future FYNSPs [Future Year Nuclear Security Plan]. Right now, I think the cost is going to be somewhere on the order of over $500 million to maybe slightly over $1 billion, but it is not defined yet, sir, and I have work to do to do that.

The last piece is the capability to create specimens and transport those to the advanced test reactor that allows us to determine how fuel and how materials will react in future cores. That is important for future design. That is the third component that we still have to do more study with our partners in DOE who run the advanced test reactor. As they think about their future requirements and infrastructure that they are going to develop, we want to do that in partnership with them to make sure that our needs are met, as well as to understand what we need to invest in specifically for naval reactors.

Senator DONNELLY. Thank you, Admiral.

Thank you, Madam Chair.

Senator FISCHER. Thank you.

Senator Warren?

Senator WARREN. Thank you, Madam Chair, and thank you, Ranking Member, for having this hearing.

And thank you to the witnesses for being here.

The administration's Nuclear Posture Review calls for two new low-yield variants to our existing nuclear arsenal, a low-yield submarine-launched ballistic missile, or SLBM, in the near term, fol-

lowed by a low-yield sea-launched cruise missile. And I would like to focus, if I can, on the SLBM for now.

Ms. Gordon-Hagerty, I understand that NNSA plans to modify, quote, a small number, closed quote, of existing W76 warheads on our Trident missiles so that they are configured for a low-yield primary only explosion.

Now, I know the W76 is already going through life extension programs. So I would like to ask you some questions just about how that is going to work in practice. I just want to try to understand this. Can you say how many W76 warheads NNSA intends to modify in this way?

Secretary GORDON-HAGERTY. Senator, that number is classified. I am not able to provide that to you. But I would be happy to do that in closed session.

Senator WARREN. Okay.

Let me ask another question then related to this. As I understand it, the current W76 life extension program is due to be completed by the end of fiscal year 2019. So how long will it take NNSA to modify the desired number, whatever that is, of warheads to detonate at a lower yield? Let me just ask related to that, do you anticipate that you can complete the low-yield modifications before the life extension production line closes at the end of this year?

Secretary GORDON-HAGERTY. Senator, we are looking into that right now, and based on the program of record administered by the Nuclear Weapons Council and approved by Congress, we are in the process, as you rightly state, of nearing the completion of our life extension program for our 76–1. We are leaning as far forward as possible, putting schedules together, plans, and the things that we are authorized to do in anticipation of receiving congressional authorization to proceed with the low-yield ballistic missile warhead.

Senator WARREN. So you cannot give me an answer right now on how long it will take to do this?

Secretary GORDON-HAGERTY. We are putting those plans together right now, as we speak, because as you rightly state, we have several life extension programs ongoing right now. This should not be a significant—this should not have a significant effect because we are, as you said, undertaking the LEP, life extension program, right now with the 76–1.

Senator WARREN. But you do anticipate that you will be able to complete before the life extension programs are completed.

Secretary GORDON-HAGERTY. It is dependent certainly on DOD requirements and when they will require to have the modifications.

Senator WARREN. So you are not certain on that yet. I just want to understand.

Secretary GORDON-HAGERTY. No. We are working with the NWC, Nuclear Weapons Council, de-action officer level to ensure we can support the scheduling.

Senator WARREN. So your budget request does not appear to specify any additional funding for the SLBM modifications called for by the Nuclear Posture Review. Are funds included for this purpose in the fiscal year 2019 request, and if so, how much?

Secretary GORDON-HAGERTY. No, there are no funds related specifically to this activity. However, we are working closely with

OMB and with DOD to ensure that any requirements necessary to be put forward for budget requirements for this process—we will be working with OMB on that.

Senator WARREN. But do you anticipate submitting a reprogramming or supplemental request, or do you expect to be using 2018 funds?

Secretary GORDON-HAGERTY. At this time, I cannot tell you how that would be submitted if necessary, but we are getting a good idea about what the costs would be associated with this modification.

Senator WARREN. And one last question. What kind of testing will you need to conduct to ensure that whatever modifications are made will not impact the safety, security, and effectiveness of the warhead?

Secretary GORDON-HAGERTY. Because this is a modification to an existing warhead, the science-based stockpile stewardship and all of the data that we have collected thus far should be adequate to meet the needs of the modification to the 76.

Senator WARREN. So you are not anticipating any additional testing?

Secretary GORDON-HAGERTY. Additional testing?

Senator WARREN. To ensure that the modifications have not —

Secretary GORDON-HAGERTY. Well, because of the science-based stockpile stewardship, the high performance computing, all of the other science and engineering practices will be applied to this as well.

Senator WARREN. You know, I am just concerned here. Thank you.

Your predecessor, retired Admiral Frank Klotz, recently gave an interview in which he said that NNSA is already, quote, working pretty much at full capacity. Given the number of life extension programs that NNSA is already overseeing and the demands of the stockpile stewardship program, I just have real concerns about your agency's capacity to take on additional work. And I think that maintaining our existing arsenal and our current program of record has to be our priority here.

Thank you, Madam Chair. Thank you.

Senator FISCHER. Thank you, Senator.

We are letting Senator Cotton collect his thoughts here before we call on him.

But, Admiral, if I could ask you a question. In 2017, the Navy acknowledged the discovery of a manufacturing defect in the prototype electric-driven propulsion system for the *Columbia*-class reactor. And can you please update us on the progress that you are having in addressing this issue?

Admiral CALDWELL. Yes, ma'am, gladly. And you are speaking specifically about the electric drive or the integrated power system for the *Columbia*-class submarine. And again, I should note that this is funded on the Navy side not on the DOE side.

We did have a manufacturing defect last year, and specifically what happened was that some of the components for a pre-production motor were not properly insulated. And what we discovered was that the sub-tier vendor did not properly flow down requirements to the manufacturer. And so as we were putting together

this prototype motor, we learned of this deficiency, and it required us to go back and have another motor built, which the sub-tier vendor is executing. And that is going to delay our testing program.

Our testing program comes together for full integration testing at a facility up in Philadelphia with life-sized, real-sized components, pre-production, and they will test the entire system end to end. And then we will take what we learned from that and roll that into the final design that will go into the first ship.

So while we have lost some time on the pre-production motor, we still have been able, with shortening some test spans and doing some work in parallel, to preserve the required 9-months margin that I have specified to the required in-yard date for construction of the ship.

The bottom line is we are still on track to support construction of the *Columbia* starting in 2021.

Senator FISCHER. So there really was not a negative impact to the larger schedule by this.

Admiral CALDWELL. It certainly put some pressure on it, ma'am, and it has required a significant amount of oversight to be able to execute it. And because we have had to overlap some portions of the test program, I think it inserts a little more risk than we would have originally preferred.

But we are managing that extremely tightly, and I get frequent reports on it. And in fact, we are starting to test with the components that we have in hand already up at the facility in Philadelphia. So we are making progress and I will continue to keep you informed on that.

Senator FISCHER. Good.

Have there been any other challenges in some of the new technology that is associated with the *Columbia*-class?

Admiral CALDWELL. The other big challenge that we have in *Columbia*-class is the manufacturing of the life of the ship core. It will be a pretty big step for us. It is going to be based on our experience with developing and building cores for many decades. And we knew this was going to be a challenge because to get to the over 40-year life of the core for *Columbia* was going to require the use of new materials.

So in 2010, we decided that we needed to go prove out the design and the ability to manufacture using these materials by building a special core to go into a reactor prototype and training site in New York. We call that core the technology demonstration core. And that has allowed us to prove that we can manufacture on a large scale and that we can meet our design requirements.

That core is nearly complete and it will be completed next year, and we will go to the Ballston Spa Kesselring site where it will refuel the S8G prototype, and that will help us prove out all the work that we have done to prepare for *Columbia.*

So we are on track, and I expect to start building the core for *Columbia* next year, thanks to the money and the support that we have gotten from this subcommittee. So, again, it is not without challenge but we are overcoming those challenges as we encounter them, and we are on track to support the required in-yard date for the *Columbia*-class submarine.

Senator FISCHER. Thank you, sir.

Senator Cotton?

Senator COTTON. Thank you. I apologize for my tardiness. I was presiding over the Senate. It was fascinating.

I want to thank you all first for the jobs you do and very important work. And it is always not work that is in the headlines, and I think we should all be thankful for that given the nature of your work, that it is not frequently in the headlines.

Secretary Gordon-Hagerty, let me just ask at a high level because I know you have addressed some of the specific programs in terms of the life extension and the modernization programs for our warheads. Is everything on track as of today?

Secretary GORDON-HAGERTY. As of today, everything is on track and on budget.

Senator COTTON. If that were to change in the future, what would be the main causes for that change? What are the risk factors that you see in the future to any of those programs?

Secretary GORDON-HAGERTY. There are some scheduling issues certainly with the W80–4. We need to continue to be in alignment with the Department of Defense on that. And also continuing sustained funding, predictable funding, is what is really going to be the cause if any of those schedules slip.

Senator COTTON. And that is it?

Secretary GORDON-HAGERTY. At the present time.

Senator COTTON. Thank you.

Admiral Caldwell, let us turn to you. I know this is not exactly in your lane today, but I suspect you have worked on it some in the past. There is obviously a lot of debate in Congress about the National Defense Strategy and the Nuclear Posture Review and the return of some low-yield weapons to our arsenal. I know there is lots of sophisticated game theory type arguments you could make. Is the simplest argument to make is that Russia has them and we do not?

Admiral CALDWELL. I think the best argument to make, sir—first off, I support the Nuclear Posture Review. I support a strong nuclear deterrent. And I think the best argument to make is no matter who the potential adversary, that our nuclear deterrent must be strong, capable, and ready and must be ready to respond across a range of future scenarios.

The important thing to note is deterrence—what really matters is what is in the mind of the adversary. If they do not think we have a capability to respond in a variety of scenarios or that we are not ready or that it is not credible, then deterrence fails. So I believe that the plans and the intent of the Nuclear Posture Review is exactly where we need to go for a strong United States.

Senator COTTON. In terms of that flexible, ready response across a range of scenarios, so one of the threats there is that if the enemy possesses low-yield warheads, say, in the single digit kiloton range, yet it perceives us only to have high-yield, city-killing types in the dozens, hundreds of kiloton or even megaton range, they think they might be able to get away with detonating a low-yield weapon because we would not respond with a high-yield weapon.

Admiral CALDWELL. That is correct, sir. We do not want an adversary to think that we are self-deterred.

Senator COTTON. Thank you.

Let us get back a little bit more into your current lane. Do you anticipate any problems in supplying additional reactors if the decision is made to increase the number of ballistic missile submarines?

Admiral CALDWELL. Sir, as of now, I am not aware of any plans to increase the number of ballistic missile submarines.

Senator COTTON. Maybe they will be coming one day.

Admiral CALDWELL. But certainly we will always welcome more submarines.

What I would tell you is we are in close dialogue with our nuclear industrial base, frequent. And we know their business well. We are good partners with them. We have had dialogues on the range of future options in terms of additional ships, including carrier build rates. And as long as the nuclear industrial base has sufficient warning, they can make the proper investments in people, equipment, and facilities to deliver what the Nation needs.

Senator COTTON. On that topic, we used to have surface ships besides aircraft carriers that were nuclear-powered. We no longer have those. Why is that?

Admiral CALDWELL. We had those cruisers, and then as they reached end of life, there was no intent to recapitalize them. And with every new ship class that comes into existence, we examine what the propulsion system should be and we assess the mission, the patrol cycles, the deployment cycles, the crew cycles. And we also assess the cost, and part of that is the cost of fuel and how the ship will be used. And in the analysis of alternatives, if it makes sense to use nuclear propulsion, we would. But to date, since the retiring of those nuclear-powered cruisers, the ships that have been manufactured and use nuclear propulsion are all carriers and all submarines, and I think that is a good thing. I know that in future scenarios, as we continue to decide what future classes we need, that we will continue to pursue these analyses of alternatives and make a decision based on cost and what the mission needs are.

Senator COTTON. Thank you.

Senator FISCHER. Thank you, Senator.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

Mr. Trimble, where do you see the greatest bottlenecks for the NNSA as we begin all of these designing production programs?

Mr. TRIMBLE. Thank you for the question.

I think that is a difficult one to answer simply because as you lay out, the complex is working at levels not seen since the Cold War, and you are operating with a very tight schedule across all the LEPs, while simultaneously doing physical modernization for the core facilities for uranium, plutonium, et cetera. So it is a very complex system that needs to be tightly managed, tightly orchestrated. So the potential for things to go off the rails anywhere is there.

By the way, if I had to pick one area, I think as you mentioned, Kansas City jumps to mind. I know we have some ongoing work looking at Kansas City for this committee. They, I believe, make roughly 80 percent of the non-nuclear components for the weapons. They are already planning to go to or already at two and three

shifts. And over the next 5 years, we have been told they are looking to hire about 1,000 people. So that is quite a daunting undertaking and it is sort a fulcrum for all of our efforts.

Throwing another challenge at Kansas City in terms of the hiring, there is another GAO high risk area dealing with security clearances. So the ability to hire those people who all need Q clearances is also going to run up into sort of the mess that is the clearance process currently in the Federal Government.

Senator DONNELLY. Thank you.

Admiral Caldwell, a life of core fuel is your current milestone for the *Ohio*-replacement program. If we go to life of core fuels for the fleet, what fuel forms of the future are you looking at?

Admiral CALDWELL. Sir, thanks for the question.

We currently manufacture life of ship fuel for all of the submarines, and for the carriers, it is a once in their life refueling at roughly the 25-year point. With *Columbia,* again, life of the ship core enables us to avoid refuelings, taking the ship off line, saves money, saves force structure.

What is next? Well, the Navy has a need for more power as we decide to put more capabilities on ships going forward. They need greater flexibility. Certainly the Navy would maybe like, in our submarine force, to have more speed. So these things require us to put more energy in the core if we can also make future cores more affordable because cost savings is something that we are focused on, as well as meeting the requirements for strong, stable, reliable nuclear propulsion.

So what is next is that we plan to do, given the money requested in the presidential budget, is to take that *Virginia* core and see how we can make some modifications to it. And our plans right now are to make some of those modifications for installation on a late model *Virginia* and then be ready for a future SSN [Submersible Ship Nuclear-Powered]. And we believe we can put some more energy in there and make it more affordable, to the tune of perhaps maybe a $50 million reduction per ship. So that is substantial.

What is after that would have to be pretty much a revolutionary change or a step change in core design using a completely different system. And we are working on that. We are making pace on that. But the next step is to take this *Virginia*-class core and take it to the next level using sort of the current model.

Senator DONNELLY. Thank you.

Secretary Gordon-Hagerty, my understanding is that in developing the fiscal year 2019 budget, we reduced the funds to the laser fusion efforts which underpin a lot of the science programs. In particular, we have proposed to phase out laser fusion at Rochester, which is the seed corn of future scientists for the weapons programs in many ways.

Have you assessed what impacts this will cause in the short and long term?

Secretary GORDON-HAGERTY. Senator Donnelly, I recently learned about this, and I have looked into it personally. We have near-term and long-term priorities in our science-based stockpile stewardship programs. And it so happens that part of the inertial confinement fusion program, of which NIF–Z [National Ignition Facility] at Sandia and NIF at—National Ignition Facility at Liver-

more, Z at Sandia, and the LLE [Laboratory for Laser Energetics] at University of Rochester, the Omega program, are part and parcel of those programs. However, because of near-term priorities in our science-based stockpile stewardship and our requirements, we have decided that it is best for us to ramp down the activities at University of Rochester. While I recognize that, yes, it is a source oftentimes of future scientists and engineers because they get some training there, we are looking at what it takes to ensure that we are supporting our science-based stockpile stewardship and management program. And therefore, we have determined that we are going to be putting it on a 3-year ramp-down.

Senator DONNELLY. Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator Donnelly.

I would like to thank the witnesses for being here today. If we do have some questions for the record and we get those submitted to you, I would hope that you could respond to us within a couple weeks with your answers.

Senator FISCHER. And with that, I thank Senator Donnelly, and the meeting is adjourned.

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

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR KIRSTEN GILLIBRAND

INERTIAL CONFINEMENT FUSION (ICF) PROGRAM

1. Senator GILLIBRAND. Secretary Gordon-Hagerty, the ICF program supports critical experimental platforms that complement and validate computer modeling to maintain the Nation's nuclear stockpile without underground nuclear weapons testing. We have worked very hard to ensure a stable program that allows the Department, its national laboratories, and its university and industry partners to plan and execute the experimental work necessary to ensure the safety and reliability of our nuclear stockpile. However, the Administration's fiscal year 2019 budget request would cut experiments at the National Ignition Facility, propose the shutdown of the OMEGA Laser Facility at the University of Rochester in New York, and terminate all university programs. The work of hundreds of scientists and researchers would end and efforts to achieve ignition, which would have tremendous benefits for the Nation's nuclear stockpile stewardship, would be considerably slowed if not abandoned. This fiscal year 2019 budget request will lead to the loss of U.S. leadership in these critical national security areas. Please provide an explanation for these proposed program cuts and explain how these proposals will not weaken the stockpile stewardship program.

Secretary GORDON-HAGERTY. The proposed budget for Fiscal Year (FY) 2019 redirects resources to the most immediate stockpile stewardship needs, reflecting difficult choices that balance priorities between meeting near-term and long-term needs for the nuclear stockpile. The Inertial Confinement Fusion Ignition and High Yield (ICF) Program will continue to provide essential data and supporting expertise required for the ongoing assessment and certification of the nuclear weapon stockpile at the proposed $419 million funding level for fiscal year 2019. This level of funding not only preserves the core of the most critical experimental capabilities supported through the ICF program, ensuring that there will be no impact to experiments supporting ongoing life extension programs, but also advances experimental platform development for weapon outputs and effects studies. In the long-term, achieving laboratory ignition remains a goal for the Stockpile Stewardship Program, as does the reconstitution of the academic alliances and university partnerships in a way that complements NNSA's Research & Development (Science) and Advanced Simulation & Computing Programs.

2. Senator GILLIBRAND. Secretary Gordon-Hagerty, I was pleased to hear during your Senate confirmation hearing that recruiting and maintaining the "best and the brightest" is a priority for you and NNSA. The OMEGA Laser Facility at the University of Rochester's (UR) Laboratory for Laser Energetics (LLE) is one of the three

leading facilities for NNSA's Inertial Confinement Fusion program. As the DOE's and NNSA's largest university-based research center, the LLE is the only major facility that trains graduate students and also supports over 400 users from 55 universities and over 35 centers and national laboratories. More than 330 UR students alone have completed their Ph.D. degrees with LLE's support and 100 students are currently conducting research there. Given that LLE clearly serves as a vital pipeline to educate and train future talent, a priority you have identified for NNSA, I was disappointed to see the budget request would propose a 50 percent cut to the LLE in fiscal year 2019 and shut it down completely in three years. How do you reconcile your testimony and prioritization of talent with the President's request? How can we ensure that LLE continues to train the future workforce to help meet our national security needs?

Secretary GORDON-HAGERTY. The role that LLE has played in educating and developing a trained workforce in the high energy density (HED) area is valued, and NNSA has recommended continued support for a University of Rochester-based research center focusing specifically on fundamental HED science and education, continuing their rich history of workforce development for the weapons program.

The proposed budget for Fiscal Year 2019 reflects difficult choices that balanced priorities between meeting near-term and long-term needs for the nuclear stockpile including workforce development and training. The ability to recruit and retain the best and brightest is a priority for NNSA, and we will continue to strive to meet this challenge across all of the scientific, engineering, and manufacturing disciplines required to meet our mission.

QUESTIONS SUBMITTED BY SENATOR JOE DONNELLY

WASTE ISOLATION PILOT PLANT

3. Senator DONNELLY. Mr. Owendoff, your budget includes major increases for the Waste Isolation Pilot Plant (WIPP) to get it back up and running. The Department has proposed to terminate the MOX program and send the plutonium to WIPP. What will the impact be on WIPP with its re-start and back logged waste from other defense sites—and is there enough room for it?

Mr. OWENDOFF. Independent of the plutonium disposition program, DOE is taking actions to ensure adequate capacity at the Waste Isolation Pilot Plant (WIPP) pursuant to its mission to accept transuranic waste streams resulting from atomic energy defense activities across the DOE complex.

The Department is pursuing a change to the method of calculating the Volume of Record consistent with the WIPP Land Withdrawal Act (LWA) capacity limit for transuranic waste of 6.2 million cubic feet (approximately 176,000 cubic meters). DOE submitted a permit modification request in January 2018 to the New Mexico Environment Department; the request is under review.

DOE is mining additional panels and pursuing the Volume of Record change whether or not additional surplus plutonium is designated for disposal at WIPP.

HANFORD SITE

4. Senator DONNELLY. Mr. Trimble, you looked at grouting as an alternative to turning the other 60 percent of the low activity waste at Hanford into glass. How much will that save and where could it be disposed of?

Mr. TRIMBLE. DOE may be able to reduce certain risks and save tens of billions of dollars by adopting alternative approaches to treat a portion of Hanford's low-activity waste (LAW).

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. This is because the Waste Treatment Plant—DOE's current planned approach to treating Hanford's tank waste—is currently designed to treat only one-third to one-half of Hanford's LAW, meaning that DOE will have to modify the WTP or build another facility to treat the supplemental LAW, whether or not vitrification is chosen as the treatment method. DOE currently plans to dispose of Hanford's vitrified LAW in an on-site landfill called the Integrated Disposal Facility. 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.

We also reported that, according a few of the 21 experts that attended GAO's meeting convened by the National Academies of Sciences, Engineering, and Medicine, Hanford's LAW could be treated and disposed of at an alternate location. DOE is currently conducting a demonstration project that would grout some of Hanford's LAW and transport it to the Waste Control Specialists' site in Texas for permanent disposal. According to DOE officials, disposal of grouted Hanford LAW at the Waste Control Specialists' site has the potential to save significant costs associated with the construction and operation of an additional vitrification facility. According to an estimate conducted by Waste Control Specialists, disposal of Hanford's LAW at the site in Texas could save DOE up to $16.5 billion when compared with the costs of constructing and operating a second vitrification facility for the treatment of supplemental LAW.

5. Senator DONNELLY. Mr. Owendoff, what is the status of the Hanford high level waste pretreatment project and are you keeping engineering capability alive while you concentrate of turning the low activity waste into glass?

Mr. OWENDOFF. Work on the Hanford Waste Treatment and Immobilization Plant's Pretreatment (PT) Facility has been suspended since 2012 because of the need to address technical issues. We are making steady progress on addressing the remaining three identified technical issues at the PT Facility including: pulse jet mixer controls, erosion/corrosion in piping and vessels and black cell equipment structural integrity.

DOE expects its contractors to effectively manage human capital to ensure the right expertise is brought to bear where and when needed.

NAVAL REACTORS DECOMMISSIONING AND CLEANUP

6. Senator DONNELLY. ADM Caldwell, I understand you are working with DOE Environmental Management to have them perform some cleanup operations. To what extent will DOE Environmental Management perform this mission and on what facilities—will it extend to the current fuel pond at Idaho when the new one is built?

ADM CALDWELL. Naval Reactors (NR) has pursued a collaboration effort with DOE–EM to capitalize on their expertise and processes to increase our rate in reducing environmental liabilities. Naval Reactors and DOE–EM are currently developing the strategic framework necessary to lay out a prioritized plan across the Future Years Nuclear Security Plan, identify the project management processes to control funding transfers and project execution, and establish appropriate memorandums of agreement to define the nature of the partnership.

The plan and budget profile for NR D&D activities over the next 5 years is required to meet current mission needs and is based on using our current NR D&D processes and subcontractor (Babcock & Wilcox Shaw Remediation [BWSR]). Naval Reactors' contract with BWSR extends through fiscal year 2019 with an option year in fiscal year 2020. BWSR will continue to perform D&D activities under the scope of this contract.

In fiscal year 2019, Naval Reactors and DOE–EM will accomplish the necessary planning and scoping activities to enable a transition to utilize DOE–EM to perform D&D work. Our goal is to be in a position to execute initial pilot projects in fiscal year 2020 and expand to other projects in future budget years. The specific pilot projects have not yet been determined.

Under this new arrangement, DOE–EM would perform large-scale D&D projects, and Naval Reactors would continue to perform unique, smaller-scale efforts (such as high-curie work within an active building) using in-house personnel or via subcontract based on the nature of the work and the most efficient use of resources.

Naval Reactors would oversee the work and establish program management checkpoints where DOE–EM must obtain approval to proceed, to be specified in a Memorandum of Agreement under development. Naval Reactors and DOE–EM would utilize the principles of DOE Order 413.3B to define and control this program of work. The work would be performed by DOE–EM contractors to DOE–EM requirements, under a DOE–EM managed contract. Naval Reactors would provide annual transfers to DOE–EM based on the approved scope.

The earliest that D&D work could commence on the Expended Core Facility at the Naval Reactors Facility in Idaho is estimated to be in the 2040s. Therefore, determination of DOE–EM involvement in the D&D of this facility will be made at a later date.

7. Senator DONNELLY. ADM Caldwell, at one point I understand you were looking at commercial sites to dispose of the decommissioned reactor vessels. What is the status of that effort?

ADM CALDWELL. Naval Reactors is preparing to conduct an Environmental Impact Statement (EIS) for CVN 65 (the first decommissioned nuclear aircraft carrier) to assess: 1) commercial recycling of the non-nuclear portions of the ship followed by reactor compartment packaging at Puget Sound Naval Shipyard (PSNS); and 2) commercial dismantlement and disposal of the reactor plants and recycling of the remainder of the ship. The EIS process will allow us to obtain input from stakeholders including the public on options for disposal. The EIS process is expected to start in the Fall of 2018 and span approximately three years.

In 2012, the Navy issued an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for disposal of the CVN 65 reactor plants at PSNS, where submarine and cruiser reactor plant disposal has traditionally been done. The eight reactor compartments would be removed from the ship as it is dismantled and individually sealed in high-integrity packages for transport to the Department of Energy's Hanford site.

However, as the technical details to actually perform the work outlined in the 2012 EA and FONSI developed, PSNS estimates for the overall cost as well as the time in drydock grew to where there was substantial doubt that the plan outlined in the EA and FONSI could be executed without additional cost and impact on active ship work. This cost and schedule growth, in part, led to a reexamination of additional alternatives. One such alternative is packaging the eight individual reactor compartments from CVN 65 as four pairs, which reduces the shipyard's efforts relative to the work outlined in the 2012 EA/FONSI. However, the larger and heavier reactor compartment disposal packages could require modification to the transportation route from Bremerton, Washington to the Hanford site.

Separately, within the last decade, the cost to commercially recycle non-nuclear Navy ships declined to almost zero, and the idea of partial commercial dismantlement was developed. The number of large commercial nuclear power plants being dismantled in the commercial industry also increased. Given that both the commercial nuclear dismantlement industry as well as the commercial shipbreaking industry offered the potential for substantially reduced cost with proven results, without impacting Navy facilities, it seemed prudent for the Navy to evaluate this alternative.

At this time, Naval Reactors does not have a preferred choice for CVN 65 disposal. The objective is to recommend an approach that is executable, environmentally responsible, and effective in the utilization of Navy resources.

SAVANNAH RIVER SITE

8. Senator DONNELLY. Secretary Gordon-Hagerty, you are looking at using the existing MOX building and its 400,000 square feet of un-finished space to machine plutonium, yet your own analysis says you need only about 100,000 square feet of that space. What are you going to do with the rest of it since this facility was custom built for making MOX fuel with 3 foot thick walls?

Secretary GORDON-HAGERTY. While no mission other than pit production has been identified for the MOX facility, it is a viable asset that can be repurposed for other high hazard missions in addition to its use as a pit production facility.

Y–12 FACILITY

9. Senator DONNELLY. Mr. Owendoff, my understanding is that you cannot tear down many Manhattan era buildings at the Y–12 plant in TN until you remediate the mercury in the ground water. How long will that take and how much will it cost?

Mr. OWENDOFF. Several of the Manhattan Project-era buildings at Y–12 are contaminated with mercury. Before we can initiate large-scale demolition of these facilities, the Environmental Management (EM) program must construct a mercury treatment facility capable of controlling mercury releases that could occur once demolition of these deteriorating structures begins.

Work is already underway on the mercury treatment facility, which will be operational in 2024, prior to our scheduled start of building demolition. Early estimates for the mercury treatment facility range from $120–$244 million, but those estimates will be refined as the project progresses.

In addition, in order to cost-effectively demolish these excess shut-down facilities, the current perimeter intrusion, detection and assessment system (PIDAS) will need to be relocated prior to the start of demolition activities. The NNSA is funding a

project to move the PIDAS, and their schedule for completing the relocation aligns with EM's schedule for demolition.

NNSA COST ESTIMATION

10. Senator DONNELLY. Mr. Trimble, what is you assessment of the cost estimation effort at the NNSA and why is it important?

Mr. TRIMBLE. Understanding the cost of programs and activities is essential to building credible budget and future spending plans. Our recent work shows that DOE and NNSA, with some exceptions, have made progress in improving the quality of its cost estimating for specific major projects and programs. For example, we found in September 2017 that DOE's revised cost estimate for completing construction of the Mixed-Oxide (MOX) Fuel Fabrication Facility substantially met best practices and can be considered reliable as it substantially met all four characteristics of a high-quality cost estimate: comprehensive, well-documented, accurate, and credible. Likewise, in May 2018, we found that NNSA substantially incorporated most of the cost estimating best practices identified by our past work when it developed the program cost estimate for the B61–12 LEP. In addition, we believe that NNSA's cost estimating capability has been enhanced by the establishment of its Office of Cost Estimating and Program Evaluation which advises the NNSA administrator on policies and procedures for cost analysis and estimation and conducts independent cost estimates for projects and programs among other activities. We note that that this office was established under the National Defense Authorization Act for Fiscal Year 2014. (Pub. L.No. 113–66, § 3112, 127 Stat. 672, 1050 (2013) (codified as amended at 50 U.S.C. §2411(a) (2018)).

Even with improved cost estimates for individual projects and programs, we have found problems with NNSA's overall long-term planning, programming, and budgeting for modernizing the nuclear weapons stockpile over the coming decades. For example, NNSA's fiscal year 2017 budget materials show that NNSA's modernization budget estimates for fiscal years 2022 through 2026 may require significant funding increases, raising affordability concerns. Moreover, in April 2017, we concluded that NNSA had not addressed a projected "bow wave" of future funding needs—that is, an impending and significant increase in requirements for additional funds—or the mismatch between potential funding needs and potential funding available. We recommended that NNSA include an assessment of the affordability of NNSA's portfolio of modernization programs in future versions of the Stockpile Stewardship and Management Plan—for example, by presenting options NNSA could consider to bring its estimates of modernization funding needs into alignment with potential future budgets. NNSA did not explicitly agree or disagree with our recommendation, but we are continuing to monitor any actions NNSA takes in response to the recommendation. We believe this recommendation may be particularly important as NNSA considers the additional program scope included in the January 2018 Nuclear Posture review is translated into program and budgetary requirements.

NNSA DNN PROGRAM MANAGEMENT

11. Senator DONNELLY. Mr. Trimble, what is your assessment of the program management at the NNSA Office Defense Nuclear Nonproliferation?

Mr. TRIMBLE. Program management involves aligning multiple components to achieve the program's goals and allows for optimized or integrated cost, schedule, and effort. The Project Management Institute (PMI) and GAO have established standards and guides that are generally recognized as leading practices for program management. When organizations apply leading program management practices they may be able to enhance their chances of achieving success across a range of programs. NNSA's Office of Defense Nuclear Nonproliferation (DNN) has issued its own program management policy, which it revised in 2017.

However, in a September 2017 report, we found limitations DNN's revised policy—including that it does not address leading practices on establishing schedule estimates, estimating life-cycle costs, and measuring against such baselines—and that DNN management does not require the programs to establish schedules and cost estimates that cover their life cycles, or conduct baseline measurements. As a consequence, we found that none of the 4 selected DNN subprograms we reviewed had schedule and cost estimates covering their planned life cycles and none measured performance against schedule and cost baselines. We recommended that NNSA revise the DNN program management policy to include requirements for DNN programs on development of schedule and cost estimates, and use of schedule and cost baselines to measure performance. These changes could help ensure that NNSA managers and Congress have better information on how much DNN programs and

subprograms may cost and subprograms may cost, the time they may need to achieve their goals, and how effectively they are being executed compared to plans.

In its written comments, NNSA neither agreed nor disagreed with our recommendation. However, NNSA stated that it plans to take action in response to the recommendation. Specifically, NNSA stated that DNN will update its program management policy to formally document current practice and clarify expectations for addressing uncertainty. NNSA said it will update the policy to: (1) reflect that lifecycle cost and schedule management should be applied at the project or subprogram level where appropriate, considering the extent of uncertainty impacting scope, potential timelines, and executability; (2) define the methodologies to (a) account for uncertainties where applying these techniques would result in a reasonable range of estimates that would be useful for planning and scheduling purposes or (b) document risk and track actions to reduce uncertainty where applicable; (3) address expectations for assessing cost and schedule performance, commensurate with the level of certainty present at baselining; and (4) address requirements for documenting program management plans. In March 2018, NNSA indicated that DNN had developed a proposal to revise the DNN policy and it was under internal review with an estimated completion by December 31, 2018.

LOW-YIELD SLBM WARHEAD

12. Senator DONNELLY. Secretary Gordon-Hagerty, is there a budget proposal yet for the low yield SLBM warhead and how much will it cost for fiscal year 2019?

Secretary GORDON-HAGERTY. As submitted in the amended Fiscal Year (FY) 2019 budget request, $65 million is requested in fiscal year 2019 for the low yield submarine-launched ballistic missile, which is now referred to as the W76–2 warhead.

QUESTIONS SUBMITTED BY SENATOR MARTIN HEINRICH

VISIT TO NEW MEXICO'S NATIONAL LABORATORIES

13. Senator HEINRICH. Secretary Gordon-Hagerty, congratulations on your confirmation as administrator; I look forward to working with you in support of the department's national security programs. I recognize you have taken on a very challenging job and already have a lot on your plate. However, I urge you to visit the NNSA's national laboratories soon to learn firsthand about their important work and the outstanding scientists and engineers that help maintain the Nation's nuclear stockpile. Will you make plans to come to New Mexico in the near future to visit both Los Alamos and Sandia National Laboratories?

Secretary GORDON-HAGERTY. Thank you for your support, and I look forward to working with you during my tenure. Since being sworn in, I have made it a priority to visit all of the laboratories, plants, and sites that comprise the National Nuclear Security Administration's (NNSA) nuclear security enterprise. I visited the Los Alamos National Laboratory in April 2018 and Sandia National Laboratories in June 2018 as well as the Lawrence Livermore National Laboratory in Livermore, California in May 2018. From ensuring the nuclear stockpile is safe, secure, and effective; to developing nuclear nonproliferation tools; and providing counter-proliferation expertise—the work done at these laboratories is central to NNSA's national security missions.

PLUTONIUM STRATEGY

14. Senator HEINRICH. Secretary Gordon-Hagerty, at your confirmation hearing last month you indicated the plutonium strategy would be a top priority. Your testimony made reference to the pending deadline Congress set in section 3141(d) of this year's NDAA for a final decision. This process has taken far longer that it should have. An AOA was completed in October 2017, but failed to consider the modular approach at LANL or produce a practical recommendation. Then, an engineering analysis was undertaken in December to inform the selection of an alternative and to support conceptual design of a preferred alternative. The engineering analysis has not been completed.

Did the engineering analysis fully evaluate the modular approach at Los Alamos National Laboratory (LANL)?

Secretary GORDON-HAGERTY. Yes. The engineering assessment includes an evaluation of the technical and functional feasibility of four different options for additional high-hazard, high-security footprint for the production of 50 war reserve pits per year. Three of these options are at Los Alamos National Laboratory (LANL) and one is at Savannah River Site. One of the three options evaluated at LANL is their proposed "modular approach." NNSA also conducted a workforce and staffing anal-

ysis to assess the common staffing requirements and enable valid comparisons between the preferred alternatives. The analysis of alternatives, engineering assessment, and workforce analysis will be used to further refine budget requests and inform a conceptual design to support Critical Decision-1 in Fiscal Year 2020.

15. Senator HEINRICH. Secretary Gordon-Hagerty, can you assure me that key stakeholders, including the subject matter experts at LANL, will review the engineering analysis and that your decision will be based on the best data available and sound cost estimates?

Secretary GORDON-HAGERTY. The engineering assessment (EA) and workforce analysis do not recommend an alternative, but are intended to provide additional information to senior NNSA decision-makers. Subject matter experts (SMEs) from Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), and the Savannah River Site (SRS) were an integral part of the EA, and an SME from each site provided their plutonium expertise and input to the EA throughout the document's development. In addition, NNSA provided a review period for additional subject matter experts from LANL, LLNL, and SRS to review the EA for factual accuracy. The EA provides additional analysis related to cost, schedule, risk, and feasibility for four options at the two alternative locations identified by the analysis of alternatives.

16. Senator HEINRICH. Secretary Gordon-Hagerty, will NNSA's Office of Cost Estimating and Program Evaluation (CEPE) fully review and report to you and the congressional defense committees on the engineering analysis?

Secretary GORDON-HAGERTY. The National Nuclear Security Administration's (NNSA) Office of Cost Estimating and Program Evaluation was part of the review process of the engineering analysis and part of the NNSA team that briefed the congressional defense committees.

17. Senator HEINRICH. Secretary Gordon-Hagerty, are you aware that the Los Alamos County Council recently passed a resolution strongly supporting LANL's role as the Nation's center of excellence for plutonium R&D and expansion of the lab's pit production capabilities?

Secretary GORDON-HAGERTY. Yes, I am aware of the Los Alamos County Council's resolution. The National Nuclear Security Administration (NNSA) greatly appreciates the vital role our partners in Los Alamos play in our national security missions. NNSA is committed to an enduring plutonium mission at Los Alamos. The Los Alamos National Laboratory is and will remain the center of excellence for plutonium R&D.

18. Senator HEINRICH. Secretary Gordon-Hagerty, working with the Nuclear Weapons Council, will you be able to propose a path forward by the 150-day deadline as directed in section 3141(d) of the fiscal year 2018 NDAA?

Secretary GORDON-HAGERTY. Per section 3141(d) of the National Defense Authorization Act for Fiscal Year 2018, I endorsed a path forward on May 10, 2018.

19. Senator HEINRICH. Secretary Gordon-Hagerty, you testified that there is no margin for further delay in modernizing NNSA's production capabilities. In light of the delay in completing the AOA, do you expect NNSA will still meet the DOD and statutory capacity requirements for pit production in 2030 enacted over three years ago in 50 USC 2538a and reconfirmed in the NPR?

Secretary GORDON-HAGERTY. Yes. NNSA remains committed to supporting an enduring 30 pit per year production capability in 2026, and an 80 pit per year capability in 2030.

TRUSTED RAD-HARD STRATEGIC MICROELECTRONICS AT SANDIA LABS

20. Senator HEINRICH. Secretary Gordon-Hagerty, the recent Nuclear Posture Review reaffirmed the need to maintain a robust capability for both research and a dedicated source of trusted radiation-hardened micro-electronics systems. The MESA facility at Sandia Labs is aging and needs to be upgraded to meet future national security requirements after 2025. What is the status and timeline to upgrade MESA to maintain the advanced R&D and production capacity of rad-hard microelectronics to meet the needs of both NNSA as well as other strategic partners?

Secretary GORDON-HAGERTY. The Silicon Fabrication (SiFab) foundry at Sandia National Laboratories (SNL) produces radiation-hardened microelectronics for U.S. nuclear warheads. DOE/NNSA is working to extend this capability at SiFab beyond 2025. The SNL SiFab Recapitalization (SSiFR) project was initiated in 2012 to procure upgraded equipment over a 7-year period (ending in Fiscal Year 2019). As

planned, this effort is nearing completion and the installation of the new, 8-inch equipment is scheduled. Real property upgrades to extend SiFab are in the planning process.

As a strategic partner, SiFab is also accredited as a trusted supplier by the Defense Microelectronics Activity, which manages the Department of Defense's (DOD) Trusted Foundry Program. DOE/NNSA continues to collaborate with the DOD as the DOD develops a comprehensive national strategy for government access to microelectronics.

LABORATORY-DIRECTED RESEARCH AND DEVELOPMENT

21. Senator HEINRICH. Secretary Gordon-Hagerty, you testified that attracting and retaining a skilled workforce is critical to NNSA's mission. To that end, I continue to be a strong supporter of a modest set-aside of funding for Laboratory-Directed Research and Development (LDRD). The LDRD investment in high-risk, high-payoff activities supports the national security mission while allowing the labs' scientists to pursue innovative solutions to some of the Nation's most challenging energy and national security problems. I am pleased that you testified that LDRD funding fosters innovation and helps attract and retain the workforce critical to our national laboratories.

Do you also support maintaining the NNSA lab directors' discretion to set aside up to 6 percent of funding for LDRD?

Secretary GORDON-HAGERTY. The National Nuclear Security Administration is supportive of a robust Laboratory Directed Research and Development (LDRD) program. LDRD is a vital asset in recruitment of a world-class scientific workforce and is critical to the maintenance and development of scientific capabilities that serve energy and national security missions. The LDRD program provides a basis for continually engaging laboratory research staff in cutting-edge and challenging work, as well as providing education and training for the next generation of scientists.

NNSA'S ALBUQUERQUE OFFICE COMPLEX

22. Senator HEINRICH. Secretary Gordon-Hagerty, I had the opportunity to tour NNSA's Albuquerque Complex in 2017. There are about 1200 federal workers housed in increasingly decrepit office buildings that date from the 1940s and 50s. The buildings do not meet even basic safety requirements. I strongly support plans to replace these inadequate facilities with a new LEED Gold building and am pleased the NNSA included funding in both the fiscal year 2018 and fiscal year 2019 budgets to fully fund the project. A groundbreaking will likely be scheduled soon and I hope you will plan to attend.

What is the status of the Albuquerque Complex project and when might construction begin?

Secretary GORDON-HAGERTY. On Friday, April 20, the National Nuclear Security Administration's (NNSA) Project Management Executive approved the start of construction for the Albuquerque Complex Project. The United States Army Corps of Engineers awarded a construction contract to Caddell Construction Company on April 24, 2018. NNSA broke ground on this new state-of-the-art facility in July 2018 and expects to complete construction by the end of 2020.

INCREASE IN CAP FOR GENERAL PLANT PROJECTS

23. Senator HEINRICH. Secretary Gordon-Hagerty, I worked last year with your office on legislation in the fiscal year 2018 NDAA to increase the statutory cap from $10 million to $20 million for general plant projects at NNSA labs and facilities. What is the status of NNSA's implementation of the increased cap for GPPs as authorized by section 3119 of NDAA18?

Secretary GORDON-HAGERTY. The increase in NNSA's General Plant Project (GPP)/Minor Construction threshold from $10 million to $20 million allows NNSA to address high-risk infrastructure deficiencies faster and more efficiently. As a result of additional funding provided in fiscal year 2018, some projects have been accelerated. The current plan is noted below. NNSA has moved to implement this new authority quickly, and per the notification provided in NNSA's fiscal year 2019 budget request, NNSA is planning the following 11 projects between $10 million and $20 million for execution beginning in fiscal year 2018 or fiscal year 2019:

- Three of the 11 projects are fully-funded in fiscal year 2018:
  - o Pantex—New Gas Analysis Laboratory
  - o Lawrence Livermore National Laboratory—New AME Polymers and Engineering Facility
  - o Los Alamos National Laboratory—TA–16–0303 Crystal Lab Refurbishment Portfolio

- Two of the 11 projects fund design in fiscal year 2018 and construction in fiscal year 2019:
  - o Pantex—Building 12–37 Secondary Electrical Feed Installation
  - o Sandia National Laboratories/CA—New Data Center Replacement Facility
- One of the 11 projects funds design in fiscal year 2018 and construction in fiscal year 2020:
  - o Lawrence Livermore National Laboratory—Building 235 and Ancillary Synthesis Chemistry Laboratories Refurbishment with Fume Hood Upgrades
- Two of the 11 projects request full funding in fiscal year 2019:
  - o Los Alamos National Laboratory—Dual Axis Radiographic Hydrodynamic Test Facility Weather Enclosure Addition
  - o Lawrence Livermore National Laboratory—Building 341 AME Mechanical Test Capability Consolidation Refurbishment
- Three of the 11 projects request design funding in fiscal year 2019 and construction in fiscal year 2020:
  - o Nevada National Security Site—Mercury Modernization New Building 23–461
  - o Lawrence Livermore National Laboratory—Building 151 High Level Radiochemistry Laboratories Refurbishment
  - o Lawrence Livermore National Laboratory—New AME Joining Capabilities and Vapor Deposition Facility

DOMESTIC PRODUCTION OF MOLYBDENUM-99

24. Senator HEINRICH. Secretary Gordon-Hagerty, NNSA currently provides funding to re-establish a domestic commercial supply of the radioactive isotope molybdenum-99 used for medical diagnostic procedures. What is your fiscal year 2019 budget request for support of this important program?

Secretary GORDON-HAGERTY. Our fiscal year 2019 request includes $10 million for laboratory support to develop domestic Mo-99 production technologies and implement cooperative agreements.

25. Senator HEINRICH. Secretary Gordon-Hagerty, do you have a forecast of what NNSA plans to spend over the following two years?

Secretary GORDON-HAGERTY. The fiscal year (FY) 2019 request includes a forecast of $10 million for both fiscal year 2020 and fiscal year 2021 for continued laboratory support.

WIPP BUDGET AND OPERATIONS

26. Senator HEINRICH. Mr. Owendoff, you testified the fiscal year 2019 request for WIPP is intended to enable increased transuranic waste shipments from other EM sites. However, I believe maintenance of WIPP must be a top priority. I continue to be concerned about the growing backlog in maintenance and repairs required to keep WIPP operating safely and efficiently. What is the current cost estimate of the accumulated maintenance backlog needed to properly maintain key infrastructure and facilities at WIPP?

Mr. OWENDOFF. The 2019 Budget proposes $47 million for repair and replacement of critical facility structures, systems, and components.

27. Senator HEINRICH. Mr. Owendoff, how much of the $403.5 million in the fiscal year 2019 request for WIPP is set aside specifically to address the maintenance backlog of critical infrastructure?

Mr. OWENDOFF. The 2019 Budget proposes $47 million for repair and replacement of critical facility structures, systems, and components.

28. Senator HEINRICH. Mr. Owendoff, it has been over a year since WIPP operations restarted. What are the remaining key milestones and the likely timeline to restore full operations at WIPP?

Mr. OWENDOFF. While DOE completed the recovery effort with the resumption of waste emplacement, the Waste Isolation Pilot Plant will operate at acceptance rate of approximately 8–10 shipments per week until critical facility structures, systems, and components are repaired or replaced and construction of the new safety significant confinement ventilation system is completed. These actions support operation at 17 shipments per week and are necessary to increase the Waste Isolation Pilot Plant emplacement capability, to ensure mining of new repository space is completed in time to ensure continuity of waste emplacement, and to sustain mining and waste emplacement operations. These key activities are expected to be completed in the 2021 timeframe.

29. Senator HEINRICH. Mr. Owendoff, how many requests for permit modifications for WIPP are currently pending, what is the class of each of the pending modifications and what is the likely schedule and timeline to complete each of these requests?

Mr. OWENDOFF. The following permit modification requests are now pending with the New Mexico Environment Department; associated class and target decision dates are shown:

Action	Class	Target Date
Volume of Record	3	Summer 2018
Panel Closure Plan	3	Summer 2018
New Utility/Access Shaft	2/3	Summer 2018
Excluded Waste Provision	3	Spring 2019
Above Ground Storage	3	Summer 2020

NEW LANL LEGACY CLEANUP CONTRACT, SECTION H, HUMAN RESOURCE MANAGEMENT

30. Senator HEINRICH. Mr. Owendoff, in December, DOE/EM awarded a new contract to N3B to manage cleanup at Los Alamos National Laboratory; the transition to the new contractor is scheduled to be complete in late April. Maintaining good relations with the existing workforce and community are vital to assuring a smooth transition. There are several important requirements of the new contractor related to the incumbent employees, including plans for workforce and benefits transition and for employee hiring preferences.

What is the status of the new contractor's required workforce transition plans?

Mr. OWENDOFF. N3B submitted its workforce and benefits transition plans, met the contract requirements, and hired many of the workers formerly employed by Los Alamos National Security. Transition to the Los Alamos Legacy Cleanup Contract was completed successfully on April 29, 2018.

31. Senator HEINRICH. Mr. Owendoff, will you hold the new contractor strictly accountable for complying with all human resource requirements of the contract for current employees, including the right of first refusal?

Mr. OWENDOFF. N3B has been and will continue to be held accountable for complying with the human resource requirements of the Los Alamos Legacy Cleanup Contract. A total of 354 right-of-first-refusal letters were sent to Los Alamos National Security employees who worked on the Environmental Management Legacy Cleanup contract.

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2019 AND THE FUTURE YEARS DEFENSE PROGRAM

THURSDAY, MARCH 22, 2018

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

BALLISTIC MISSILE DEFENSE POLICIES AND PROGRAMS

The subcommittee met, pursuant to notice, at 2:35 p.m. in Room SR–232A, Russell Senate Office Building, Senator Deb Fischer presiding.

Members present: Senators Fischer, Cotton, Sullivan, and Donnelly.

OPENING STATEMENT OF SENATOR DEB FISCHER

Senator FISCHER. The hearing will come to order.

The Strategic Forces Subcommittee meets today to review the administration's fiscal year 2019 budget request for missile defense spending and to discuss related policies with our witnesses.

This is an incredibly important and timely discussion given the increasing missile threats facing our Nation. Over the past year, we have witnessed dangerous advances in North Korea's ballistic missile capabilities. Kim Jong-un conducted a record number of ballistic missile tests, including tests of two new systems that appear to have a range sufficient to hold the United States at risk.

The administration has responded to this growing threat. In September, the Department of Defense submitted a request to reprogram about $400 million in fiscal year 2017 funds towards urgent missile defense requirements. Additionally, in November, the Administration amended its fiscal year 2018 budget request to include almost $4 billion in additional funds for missile defense and defeat activities, including the expansion of our Ground-Based Midcourse Defense system by an additional 20 interceptors by 2023. This robust support for missile defense continues in the fiscal year 2019 request, which includes almost a 25 percent increase in the Missile Defense Agency's budget.

While I strongly support these increases, it is this subcommittee's responsibility to ensure they meet the war-fighter's needs today and invest in advanced technology to stay ahead of tomor-

row's threats. Furthermore, while North Korea ballistic missiles remain the principal threat against which our Homeland missile defenses are arrayed, it represents only a portion of the broader missile threat. A report released last year by the National Air and Space Intelligence Center noted that Russia retains the largest force of strategic ballistic missiles, while China has the most active and diverse ballistic missile development program in the world, and both Nations continue to invest in hypersonic and cruise missiles designed to strike forward-deployed U.S. forces and in some cases the Homeland.

Testifying on these issues before us today is a distinguished panel. We have John Rood, Undersecretary of Defense For Policy; and General Lori Robinson, Commander of U.S. Northern Command and NORAD [North Atlantic Aerospace Defense Command].

General Robinson, as this is likely the last time, we will hear from you in anticipation of your retirement, I also want to thank you for your 36 years of distinguished service to this country. Thank you, ma'am. I think I speak for all of us when I say it has been a pleasure to work with you, and we wish you the best of luck.

We are also joined by Lieutenant General Sam Greaves, Director of the Missile Defense Agency; and Lieutenant General James Dickinson, who holds the title of Commanding General, United States Army Space and Missile Defense Command, among many others.

Thank you all for being with us today. We look forward to your comments.

I would now like to recognize our Ranking Member, Senator Donnelly, for any opening remarks he would like to make.

STATEMENT OF SENATOR JOE DONNELLY

Senator DONNELLY. Thank you, Madam Chair.

I would like to thank all the witnesses; and, General Robinson, congratulations. Thank you for all your service to our country, for all the amazing things you have done for our Nation to make it stronger.

I want to thank Senator Fischer for holding this hearing.

Let me also thank today's witnesses for testifying. We very much appreciate your time and the work you do every day in the service of our Nation.

Protecting our country, our forward-deployed troops, and our allies around the world is of the utmost importance, and the threats have not stood still since this subcommittee last met on this subject.

For just one example, as General Greaves and I discussed yesterday, North Korea has made rapid progress on its intercontinental ballistic missile capability. As we await the release of the Missile Defense Review, it's important we take this opportunity to review the fiscal year 2019 budget request to ensure it provides sufficient resources to continue the work of getting our missile defense systems to perform reliably and effectively.

We also need to continue improving our sensor and discrimination capabilities so we have a better picture of the threats, and we

need to continue to conduct smart simulation and testing before we commit to buying new technologies.

While we continue to improve the Homeland defense systems, we should not take our eyes off the ball when it comes to protecting our deployed troops and reassuring our allies and partners. The demand from our combatant commanders for Aegis, THAAD [Theatre High Altitude Area Defense], and Patriot batteries remains high. We need to consider how we can best allocate these systems and effectively train the war fighters who will operate them to provide the protection that is needed in today's demanding environment.

Again, thank you for coming today. We look forward to the dialogue and to your testimony.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator Donnelly.

Secretary Rood, I'd like to welcome you. If you would like to make comments to the committee?

STATEMENT OF HONORABLE JOHN C. ROOD, UNDER SECRETARY OF DEFENSE FOR POLICY, DEPARTMENT OF DEFENSE

Secretary ROOD. Thank you, Madam Chairwoman, Ranking Member Donnelly, distinguished members of the committee. Thank you for the opportunity to testify today on behalf of the administration's fiscal year 2019 budget request.

With regard to the security environment, today the United States faces an increasingly complex security environment in which the central challenge to our prosperity and security is the reemergence of long-term strategic competition driven by revisionist powers in China and Russia. Although they pose separate challenges with unique attributes, both China and Russia seek to reshape the world order and change territorial borders. Consequently, they pose increasing security threats to the United States and our allies and partners.

Long-term competition with China and Russia requires increased United States and allied and partner military investment because of the magnitude of the threats they pose today and the potential that such threats will increase in the future. We also must simultaneously strengthen our efforts to deter and counter the clear and present danger posed by rogue regimes such as North Korea and Iran.

The U.S. military remains the strongest in the world. However, our advantages are eroding as potential adversaries modernize and build up their conventional and nuclear forces. In particular, they are fielding a broad and expanding arsenal of new and more advanced missiles capable of threatening the U.S., our forces abroad, and our allies and partners.

Although this picture is unsettling and not what we desire, as Secretary of Defense Mattis has pointed out, and I quote, "We must look reality in the eye and see the world as it is, not as we wish it to be."

The Administration has heeded this admonition in recent strategic reviews, in the National Security Strategy, the National Defense Strategy, as well as the Nuclear Posture Review. They reflect

a consistent and pragmatic assessment of the threats and uncertainties we face in the future security environment.

Our task at DOD [Department of Defense] is to ensure that U.S. military advantages endure and, in combination with other elements of national power, that we are fully able to meet the increasing challenges to our national security.

With this as the strategic context, let me turn to a discussion of the fiscal year 2019 budget request for missile defense and the policies, programs, and capabilities it supports. The Department's budget request supports the President's direction set out in the National Security Strategy to deploy a layered missile defense system to protect the American Homeland from North Korean and Iranian missile threats. The request also supports regional missile defenses to protect our deployed forces, allies, and partners. Our missile defense system not only protects the United States, it strengthens the deterrence of war and the assurance of allies and partners.

Today the GMD, or Ground-Based Midcourse Defense system, provides protection for the Nation. General Greaves and others will discuss some of its attributes. But as noted by you, Senator Fischer, in September of last year, DOD requested the reprogramming of 2017 funding of more than $400 million to counter the North Korean missile threat. We appreciate the support that we received from Congress for this request.

A portion of these funds supports the important Homeland defense activities, including initiating work on the procurement of 20 additional ground-based interceptors in Alaska as early as 2023, which will bring the total to 64 fielded interceptors. This reprogramming also funded a service life extension to the COBRA DANE radar in Alaska, and software upgrades to the Sea-Based X-Band radar, which are both essential elements of our Homeland defense. Last November, the President submitted an amendment to the fiscal year 2018 budget request for $4 billion of additional funding for missile defense, which includes construction of a new missile field at Fort Greely, Alaska, and additional procurement funding necessary for the 20 GBIs [Ground-Based Interceptors].

The fiscal year 2019 budget request includes $9.9 billion for the Missile Defense Agency and $3 billion for air and missile defense programs in the Services. This budget funds a more capable ground-based interceptor with the Redesigned Kill Vehicle; the deployment of new missile tracking and discrimination sensors in Alaska, Hawaii, and the Pacific region; and a new space-based kill assessment capability. These near-term investments will enable us to obtain substantially more performance and efficiency out of the GMD systems necessary to meet the evolving threat.

We are also moving forward to bolster Homeland defenses against air and cruise missile threats. In 2018, we will complete the first part of a two-phase effort to provide effective surveillance against missile threats to the National Capital Region. Doing so will enhance our ability to detect, track, and investigate suspicious aircraft, as well as cruise missiles and, when necessary, cue our missile defense systems against the full spectrum of air threats. We are on track to begin the second phase of this effort in fiscal year 2019. We are also looking into technologies and concepts that

could be used to provide scalable and deployable options for expanding this capability.

The Department's fiscal year 2019 budget request also continues deployment of regional missile defenses tailored to meet missile threats to United States forces abroad and allies and partners in Europe, the Middle East, and the Indo-Pacific region. The budget enhances our regional missile defense capacity through additional Patriot missiles as well as THAAD, SM–3 Block IB, and SM–3 Block IIA interceptors. Our focus is on developing and fielding capabilities that are mobile and re-locatable, which allows us flexibility to respond to a crisis or conflict wherever it emerges.

We are also encouraging our allies and partners in Europe, the Middle East, and in Asia to acquire MD [Missile Defense] capabilities and strengthen missile defense cooperation in order to move towards a more interoperable and integrated missile defense architecture.

Looking forward, it's clear potential adversaries are modernizing and expanding their missile capabilities. We must ensure that our missile defense investment and strategy enable us to meet the most dangerous missile threats today, while enabling us to counter future missile threats as they expand. Areas for work on advanced technology include improved discrimination in our sensor architecture, lasers to intercept offensive missiles during their most vulnerable boost phase of flight, evaluating space-based sensor concepts, and the multi-object kill vehicle.

Let me conclude by saying that in an increasingly complex and threatening security environment, DOD must sustain the capabilities needed to deter and defend against attacks on our Homeland, U.S. forces deployed abroad, allies and partners. We must make the investments needed to address the ongoing erosion of our operational advantages and remain the preeminent military power in the world.

Thank you again for the opportunity to testify. I look forward to your questions.

[The prepared statement of Secretary Rood follows:]

PREPARED STATEMENT BY SECRETARY JOHN ROOD

Chairwoman Fischer, Ranking Member Donnelly, and distinguished Members of the Committee. Thank you for the opportunity to testify on the President's Fiscal Year 2019 Budget Request in support of the Department's efforts to improve our missile defense capabilities so that we remain ahead of the evolving threat while providing effective, integrated and interoperable regional missile defenses in support of our global defense strategy.

SECURITY ENVIRONMENT AND STRATEGIC PRIORITIES

Today, the United States faces an increasingly complex security environment, in which the central challenge to our prosperity and security is the reemergence of long-term strategic competition by revisionist powers in China and Russia.

Although they pose separate challenges with unique attributes, both China and Russia seek to reshape the world order and change territorial borders. Consequently, they pose increasing security threats to the United States, and our allies and partners.

Long-term competition with China and Russia requires increased U.S and allied and partner military investment because of the magnitude of the threats they pose today, and the potential that such threats will increase in the future. We also must simultaneously strengthen our efforts to deter and counter the clear and present dangers posed by rogue regimes such as North Korea and Iran.

The U.S. military remains the strongest in the world. However, our advantages are eroding as potential adversaries modernize and build-up their conventional and nuclear forces. In particular, they are fielding a broad and expanding arsenal of new and more advanced missiles capable of threatening the United States, its forces abroad and its allies and partners.

Although this picture is unsettling and clearly not what we desire, as Secretary of Defense Mattis has pointed out, "We must look reality in the eye and see the world as it is, not as we wish it to be."

The Administration has heeded this admonition in recent strategic reviews—the *National Security Strategy,* the *National Defense Strategy,* and the *Nuclear Posture Review.* They reflect a consistent and pragmatic assessment of the threats and uncertainties we face regarding the future security environment.

Our task at the Defense Department is to ensure that U.S. military advantages endure and, in combination with other elements of national power, we are fully able to meet the increasing challenges to our national security.

Strengthening our alliances and attracting new partners are a critical element of retaining our advantages. As the National Defense Strategy points out; "Mutually beneficial alliances and partnerships are crucial to our strategy, providing a durable, asymmetric advantage that no competitor or rival can match. This approach has served the United States well, in peace and war."

MISSILE DEFENSE POLICY AND POSTURE

With this as the strategic context, let me turn to a discussion of the fiscal year 2019 Budget Request for missile defense and the policies, programs and capabilities it supports. The Department's budget request supports the President's direction set out in the *National Security Strategy* to deploy a layered missile defense system to protect the American Homeland from North Korean and Iranian missile threats. The request also supports regional missile defenses to protect our deployed forces, allies, and partners. Our missile defense system not only protects the United States, it strengthens the deterrence of war and the assurance of allies and partners.

Today, the Ground-Based Midcourse Defense (GMD) system provides protection for the Nation. It consists of 44 Ground-Based Interceptors (GBI) deployed in Alaska and California; land-, sea-, and space-based sensors; and a command and control system operated 24/7 by trained servicemembers. We are strengthening this system and investing in technologies to ensure that we can continue to counter rogue state missile threats to our Homeland.

In September 2017, DOD requested the reprogramming of fiscal year 2017 funding of more than $400 million to counter the North Korean missile threat. Congress approved this request. A portion of these funds supports important Homeland defense activities, including initiating work on the procurement of 20 additional GBIs in Alaska as early as 2023, which will bring the total to 64 fielded interceptors. The reprogramming also funded a service life extension to the Cobra Dane radar in Alaska and software upgrades to the Sea-Based X-Band (SBX) radar—both essential elements of our Homeland defense. In November 2017, the President submitted an amendment to his fiscal year 2018 budget request for $4.0 billion for missile defense which includes construction of a new missile field at Fort Greely, Alaska, and additional procurement funding necessary for the 20 new GBIs.

The fiscal year 2019 budget request includes $9.9 billion for the Missile Defense Agency and $3 billion for air and missile defense activities in the Military Departments. This budget funds: a more capable GBI with the Redesigned Kill Vehicle; the deployment of new missile tracking and discrimination sensors in Alaska, Hawaii, and the Pacific region; and a new Space-Based Kill Assessment capability. These near term investments will enable us to obtain substantially more performance and efficiency out of the GMD systems necessary to meet the evolving threat.

We are also moving forward to bolster Homeland defenses against air and cruise missile threats. In 2018, we will complete the first part of a two-phase effort to provide effective surveillance against these missile threats to the National Capital Region (NCR). Doing so will enhance our ability to detect, track, and investigate suspicious aircraft, as well as cruise missiles, and when necessary, cue our missile defense systems against the full spectrum of air threats. We are on track to begin the second phase of this effort in fiscal year 2019, which will expand our capability to detect, ID and take defensive action before air threats can strike potential targets within the NCR. We are also looking into technologies and concepts that could be used to provide scalable and deployable options for expanding this defensive capability.

The Department's fiscal year 2019 budget request also continues deployment of regional missile defenses tailored to meet missile threats to U.S. forces abroad and

allies and partners in Europe, the Middle East, and the Indo-Pacific region. The budget enhances our regional missile defense capacity through additional Patriot missiles as well as Terminal High Altitude Defense (THAAD), SM–3 Block IB, and SM–3 Block IIA interceptors. Our focus is on developing and fielding missile defense capabilities that are mobile and relocatable, which allows us flexibility to respond to a crisis or conflict wherever it emerges. Because systems such as Patriot, THAAD, and our Aegis BMD capable ships can be surged when and where required, they make it possible to deploy layered missile defense capabilities that are responsive to regional missile threats as they arise.

We are also encouraging our allies and partners in Europe, the Middle East and Near East Asia to acquire missile defense capabilities, and to strengthen missile defense cooperation in order to move towards a more interoperable and integrated missile defense architecture against hostile ballistic and cruise missile threats.

Looking forward, it's clear potential adversaries are modernizing and expanding their missile capabilities. We must ensure that our missile defense investment strategy and priorities enable us to meet the most dangerous missile threats today, while also enabling us to counter future missile threats as they expand. Areas for work on advanced technology include improved discrimination in our missile defense system sensor architecture, lasers to intercept offensive missiles during their most vulnerable boost phase of flight, evaluating new space-based sensor concepts, and the multi-object kill vehicle.

CONCLUSION

Mr. Chairman, let me conclude by stating that in an increasingly complex and threatening security environment, DOD must sustain the capabilities needed to deter and defend against attacks on our Homeland, U.S. forces deployed abroad, allies and partners. We must make the investments needed to address the ongoing erosion of our operational advantages and remain the preeminent military power in the world.

Thank you again for the opportunity to testify. I look forward to your questions.

Senator FISCHER. Thank you, Mr. Secretary.

Your full statements will be included in the record.

General Robinson?

STATEMENT OF GENERAL LORI J. ROBINSON, USAF, COMMANDER, UNITED STATES NORTHERN COMMAND AND COMMANDER, NORTH AMERICAN AEROSPACE DEFENSE COMMAND

General ROBINSON. Ma'am, first of all, thank you very much. I am certainly honored to be sitting here and testifying with this committee, especially along with my brothers. It's an honor for me.

What has been mentioned is the strategic environment and threats facing our Nation continue to evolve, as you have both mentioned. Our adversaries are taking deliberate steps to extend their operational reach and are developing new capabilities to range targets in North America, in the United States and Canada.

At U.S. Northern Command and NORAD, we understand the urgency of keeping pace with these evolving threats. We also recognize that North Korea represents the most immediate threat to our Homeland and therefore remains NORTHCOM's highest priority.

I'm confident that the Ground-Based Midcourse Defense system can defeat the threat today, and I've testified in front of every committee and have said so, and I remain confident. I strongly support the continued improvements to the ballistic missile defense enterprise in order to maintain our advantage. We continue to work with the Missile Defense Agency, the intelligence community, and other combatant commands as part of our collaborative effort to out-pace the threat.

I'm grateful, quite frankly, for the committee's approval of the fiscal year 2017 above-threshold reprogramming and support the budget amendment, and this will increase the systems capability and capacity.

Under my NORAD responsibility, advanced cruise missiles with a low-rate arc cross-section represent a challenge to our air defense systems. Russia continues to modernize its delivery systems, long-range bombers, and strategic submarines capable of launching from distances not previously seen, reducing the indication and warnings we are likely to receive from a combat launch. To defend against these advanced cruise missiles, we must make prudent investments, as you both have talked about, and we appreciate in advance sensors and defensive weapon systems to protect our Nation's vital assets.

The men, the women, the warriors of U.S. Northern Command and NORAD stand united in a common purpose, ready to face the threats to the United States and Canada today, and we are evolving to face the threats of tomorrow. Ladies and gentlemen, you need to know, we have the watch.

Ma'am, sir, as you both have indicated, I'm getting to have the privilege to retire. I have to tell you both that after 36 years of serving my Nation, and after these last two years of having this sacred responsibility of defending our Nation, I want you both to know, I want all of you to understand my gratitude and my heartfelt appreciation for what you do to support NORAD and U.S. Northern Command every day to our Nation's Armed Forces—soldiers, sailors, airmen, marines, civilians, and in my NORAD hat, the Canadians. What you do each and every day—you know, people say to me, hey, thank you for what you do, but I know I can't do what I do if you don't do what you and your back-benchers do each and every day.

So, thank you very much. I welcome your questions.

[Applause.]

[The prepared statement of General Robinson follows:]

PREPARED STATEMENT BY GENERAL LORI J. ROBINSON

INTRODUCTION

Chairman Fischer, Ranking Member Donnelly, and distinguished members of the Committee, thank you for the opportunity to appear before you today as the Commander of United States Northern Command (USNORTHCOM) and North American Aerospace Defense Command (NORAD). As the Commander of two unique but complementary commands, I am honored to lead a truly remarkable team of professionals and patriots committed to defending our Nations against an ever-expanding array of threats. I am also deeply grateful for this Committee's support, especially in light of the wide range of threats and challenges addressed by USNORTHCOM and NORAD.

As USNORTHCOM and NORAD look to the future, it is increasingly necessary to assess the potential for seemingly far-flung events to unfold in ways that have a direct effect on our Homeland defense missions. Adversaries such as North Korea continue to field advanced weapons systems, often at an unexpectedly rapid pace of development, while China and Russia have expanded their military presence into areas outside their traditional areas of operations. The long-term consequences of these developments remain to be seen, but in an environment in which the only constant is change, it is certain that defending our Homelands increasingly relies on a modern, ready, and well-trained force, along with innovative thinking and close collaboration across borders, agencies, and boundaries.

STRATEGIC ENVIRONMENT

The threats our Nations face continue to evolve. An increasing number of foreign states are developing new ways to hold our Homeland at risk in an effort to offset Western military advantages and limit our options in a crisis.

NORTH KOREA

Over the last year, Kim Jong-un's pace of weapons testing, defiance of international norms, and deliberate efforts to reduce our indications and warning have established North Korea as the most immediate strategic threat to the United States. I testified last year I was concerned Kim Jong-un's willingness to fail in public would eventually enable him to develop a viable weapon system that could threaten the continental United States. That development has continued at an extraordinarily rapid pace, and in 2017, North Korea successfully flight tested such an intercontinental ballistic missile on three occasions, demonstrating for the first time a credible capability to hold the United States at risk.

Kim Jong-un's possession of a viable intercontinental ballistic missile represents an obvious threat to the United States, and close collaboration with the intelligence community, the Missile Defense Agency, and fellow combatant commands remains essential to outpace North Korea's technological development and deception programs. I am grateful to the members of this Committee for your continued investment in the technology and capabilities necessary to defend the United States against a North Korean threat that is only increasing with time. Adding to the capabilities that provide advanced indications and warning of missile launches will continue to be a priority for USNORTHCOM as North Korea adds capability and capacity and improves its denial and deception programs.

RUSSIA

With a full suite of delivery platforms and weapons systems capable of ranging targets throughout the United States and Canada, Russia remains the only existential air domain threat our two nations face. Russian leaders regularly exercise conflict with the United States and are investing heavily to modernize their forces and develop novel weapons to ensure their ability to hold the United States and Canada at perpetual risk.

Russian out-of-area flight activity has declined since the record levels we observed during the 2014 Ukraine crisis, but Russian heavy bombers continue to fly off our coastlines on a periodic basis, including the series of patrols that NORAD fighters intercepted near Alaska last April and May. Russia has also been cycling its aging bombers through a modernization program that enables them to carry a new generation of advanced cruise missiles that have been proven in combat against targets in Syria.

Russia also launched next-generation cruise missiles against targets in Syria from ships and submarines in 2016 and 2017 and is fielding stealthy new naval platforms, including the *Severodvinsk*-class guided missile submarine and new Dolgorukiy-class ballistic missile subs. Together, these advancements represent a significant investment by the Russian Government in their strategic fleets that are likely to hold targets at risk in the United States and Canada for years to come.

CHINA

China is pursuing a comprehensive military modernization program that includes a rapid expansion of its strategic forces intended to deter an attack from the United States by holding our Homeland at risk. Over the last decade, China has supplemented its modest silo-based ballistic missile force with dozens of road-mobile intercontinental ballistic missiles and operationalized its first class of ballistic missile submarines. As part of an effort to demonstrate global reach and influence, China's navy has developed a pattern of sending ships to "distant oceans," and in July of this year, we saw the first Chinese intelligence collection ship operate near the United States. This followed the transit of a small group of Chinese ships through the Aleutian Islands in September 2015, the first-ever instance of Chinese naval vessels operating in the Bering Sea.

IRAN

Iran is not yet able to strike the United States with strategic weapons. Nonetheless, Tehran has expended significant resources on its ballistic missile, space launch, and civil nuclear capabilities and could develop an intercontinental ballistic missile relatively quickly if its leaders chose to do so. Currently, Iran retains the ability to conduct attacks in our Homeland via covert operations and terrorist proxies.

USNORTHCOM AND NORAD

USNORTHCOM and NORAD are separate commands with common purpose, as USNORTHCOM defends the United States against land- and sea-based threats and intercontinental ballistic missiles, while NORAD defends the United States and Canada against threats in the air domain.

Established in the aftermath of the 9/11 attacks, USNORTHCOM is the U.S. geographic combatant command responsible for operations in North America, to include The Bahamas. For over 15 years, USNORTHCOM has defended the United States through the execution of no-fail missions such as intercontinental ballistic missile defense and defense support of civil authorities.

NORAD is the bi-national United States and Canadian command responsible for aerospace warning, aerospace control, and maritime warning in the United States and Canada. In May of this year, we will celebrate the 60th anniversary of NORAD's establishment and honor the proud legacy of a unique organization that has drawn its strength from the unbreakable bond between our nations. United States and Canadian personnel work side-by-side in the combined USNORTHCOM and NORAD headquarters and in each of the NORAD regions in the United States and Canada.

NORAD represents the gold standard for military collaboration, and its mission continues to be of vital importance to the defense of the United States and Canada as our adversaries continue to modernize their arsenals and develop advanced weapons systems, to include upgraded bombers and advance cruise missiles capable of holding the United States and Canada at risk.

HOMELAND DEFENSE

Ballistic Missile Defense

In light of the strategic threat presented by North Korea, defending the United States against intercontinental ballistic missiles remains USNORTHCOM's highest priority mission. The rapid advancement of the North Korean intercontinental ballistic missile is my primary focus, although I also continually monitor Iranian technology programs that could present a threat in the future.

I am confident the Ground-Based Midcourse Defense System can currently defend the United States from the threats posed by North Korea, but we must take prudent steps to remain in a position of relative technological advantage. I support the Department of Defense's efforts to improve the ballistic missile defense enterprise, and I continue to prioritize improvements to the intercontinental ballistic missile defense sensor architecture to enhance system resiliency and target discrimination, followed by improvements to interceptor reliability and lethality, along with continued reassessment of our interceptor capacity.

As our adversaries develop and field more sophisticated intercontinental ballistic missiles, improved target discrimination will improve the likelihood of a successful engagement. Upgrades to our ability to distinguish re-entry vehicles from non-lethal missile components will significantly improve engagement efficiency while maintaining required effectiveness.

Improved discrimination capability will increase the likelihood of a successful intercept, and the Missile Defense Agency is developing additional radars such as the Long Range Discrimination Radar in Alaska and a persistent radar on Hawaii, both of which will provide improved target discrimination and a more survivable sensor network. In November, the Missile Defense Agency emplaced the last of the 44 ground-based interceptors in our inventory, while continuing their important efforts to improve interceptor reliability in the fielded fleet while developing new variants for future deployment.

In light of the mounting challenges of defending the United States against intercontinental ballistic missile attack, I am grateful to the defense committees for approving the Department's fiscal year 2017 above-threshold reprogramming and supporting the budget amendment that will increase the Ground-Based Midcourse Defense system's capacity and capability. That investment in improved target discrimination and more reliable kill vehicles will improve our ability to defend the Homeland. I will continue to work with my mission partners in the Missile Defense Agency, the intelligence community, and fellow combatant commands to identify and prioritize additional initiatives that will keep us on or ahead of the threat.

As part of that effort, USNORTHCOM supported the Office of the Secretary of Defense in updating the Missile Defense Review. This foundational review will provide overarching policy direction for the missile defense enterprise, and I support its near- and long-term initiatives to ensure we remain ahead of our adversaries. As the warfighter responsible for the defense of the United States, USNORTHCOM will continue to work with our fellow combatant commands to integrate offensive

and defensive capabilities as part of a coherent strategy to defeat the missile threats facing our Nation.

Aerospace Warning and Aerospace Control

Since its establishment in May of 1958, NORAD has defended Canadian and United States airspace against an ever-evolving range of threats. Originally focused on preventing Soviet bombers from reaching targets inside the United States and Canada with nuclear gravity bombs, this unique bi-national command has kept our airspace secure and monitored our maritime approaches while constantly looking to the future in order to adapt to new technologies and outpace emerging threats. From the Cold War, through the aftermath of 9/11, and into the modern era, Canadians and Americans have stood shoulder-to-shoulder in defense of our skies, our cities, and our citizens.

NORAD's original mission remains as important as ever, as seen on 20 April 2017, when United States F–22 Raptors and Canadian CF–18 Hornets conducted a textbook intercept of two Russian TU–95 BEAR–H bombers that had penetrated the North American Air Defense Identification Zone and the Canadian Air Defense Identification Zone. That safe and professional intercept was the direct result of constant planning, coordination, and training between various NORAD commands over the course of many years.

The ability to deter and defeat threats to our citizens, vital infrastructure, and national institutions starts with successfully detecting, tracking, and positively identifying targets of interest approaching and within U.S. and Canadian airspace. As part of an ongoing effort to defend the United States and Canada against a wide range of airborne threats—from modern strike aircraft and advanced air- and submarine-launched cruise missiles to small drones—NORAD planners continue to develop a modern three-phase Homeland Defense Design that links advanced sensors capable of detecting and tracking potential threats with weapons systems capable of neutralizing targets identified as hostile.

Low Radar Cross Section Threats

This Homeland Defense Design will play an ever-more important role in defending the Homelands against modern cruise missiles and other unmanned aerial systems. Small commercial drones, light aircraft, and advanced cruise missiles each present challenges to our air defense systems due to their low radar cross sections and corresponding ability to evade detection by legacy radars. Whether those technologies are purpose-built or are unintentionally exploitable by bad actors, the potential threat from airborne platforms with small radar signatures will become commonplace in the coming years as advanced missile technology proliferates and commercial unmanned systems become ever more readily available. From a threat-assessment perspective, low radar cross section systems are of particular concern as they have the potential to hold our vital institutions and infrastructure at risk due to their ability to evade detection, tracking, identification, and, if necessary, engage targets identified as hostile.

Cruise Missile Defense

Russia has prioritized the development of advanced cruise missiles capable of holding targets within North America at risk from distances not previously seen. These systems present an increasing threat to North America due to their long range, low radar cross section, and the limited indications and warnings likely to be seen prior to a combat launch. While the likelihood of a Russian kinetic strike against the United States and Canada is currently low, it is prudent to invest in advanced sensors and defensive weapons systems to protect our Nations' vital assets.

I have confidence in the layered approach provided by overlapping air defense systems. However, I am concerned about the potential for those advanced cruise missiles, which can be launched from bombers or submarines at much greater ranges than legacy systems, to penetrate our air defense network due to their expanded range, low visibility, and limited radar cross section. The significantly improved range of these missiles has reduced the indications and warnings we are likely to receive prior to a combat launch, and their low radar cross section has required NORAD to adapt new tactics, techniques, and procedures to counter them.

We must continue to invest and innovate to stay ahead of this emerging threat, and we have made significant advancements as part of those ongoing efforts. To that end, I would like to thank the defense committees for fully funding the Department's request for funding the procurement of Active Electronically Scanned Array radars to significantly improve the ability of our fighter aircraft to detect and engage advanced cruise missiles. Active Electronically Scanned Array radars and the network of ground-based sensors integrated under the Homeland Defense Design

will provide important improvements to our ability to counter an expanding set of airborne threats.

Canada

The United States and Canada share the longest undefended international border in the world, and our collaborative relationship is one of the closest and most extensive in history. This relationship reflects a unique friendship, underpinned by common values, that has evolved over the course of the last century.

In May 2018, NORAD celebrates its 60th birthday defending the United States and Canada in the air domain. We continue to evolve this venerable relationship to keep pace with evolving threats to ensure our bi-national defense can deter, and if necessary, defeat potential future attacks. NORAD prioritizes interoperability and command and control through regular operations, combined training and exercises, combined planning, information and intelligence sharing, and personnel exchanges to ensure we are capable of conducting operations together, across the spectrum of conflict.

A critical component of our operational defense framework is the tri-command relationship between USNORTHCOM, NORAD, and the Canadian Joint Operations Command. Together, we are working to further integrate our operational framework into an adaptive continental defense arrangement that can function across multiple domains to defend the United States and Canada that preserves each nation's ability to conduct unilateral national missions such as disaster response.

CONCLUSION

Above all, I am proud to serve alongside the remarkable men and women of USNORTHCOM and NORAD as they stand guard over our Homelands against a rapidly evolving and increasingly complex set of threats. Their proud histories and future successes are deeply rooted in a shared, unshakable commitment to protecting our citizens and defending our common values. Together with our allies and partners, I am confident we will continue to adapt, innovate, and fulfill the sacred responsibility of defending our great Nations.

"We have the watch"

Senator FISCHER. Thank you, General.

General Greaves?

STATEMENT OF LIEUTENANT GENERAL SAMUEL A. GREAVES, USAF, DIRECTOR, MISSILE DEFENSE AGENCY, DEPARTMENT OF DEFENSE

Lieutenant General GREAVES. Chairman Fischer, Ranking Member Donnelly, distinguished members of the subcommittee, thank you for this opportunity to testify on the Missile Defense Agency's budget request for fiscal year 2019.

I would first like to express our appreciation to this committee for its support of the Department's above-threshold reprogramming request in September 2017 and the fiscal year 2018 budget amendment, which provided reprogramming approval and emergency funding to enhance the Nation's missile defeat and defense capabilities.

I'm also pleased to report that we are executing those funds with the utmost urgency.

I would also like to take a second to thank the thousands of men and women across government and industry who work tirelessly every single day across the globe in support of our Nation's ballistic missile defense system. They remain our asymmetric advantage.

Over the past year we have been given a clear and unambiguous message from the President that we are committed to expanding and improving a state-of-the-art missile defense system. So in my mind, the time for delays and more studies and more objections is over. As I say it, the threat has voted and continues to visibly vote through a demonstration of capabilities.

Last summer I laid out three Missile Defense Agency priorities to help guide our actions, our behavior, and program planning. First, we will continue to focus on increasing the system reliability to build more fighter confidence. Second, we will increase engagement capability and capacity. Third, we will address the advance threat.

I can tell you that the current ballistic missile defense system meets today's threat. However, as the threat increases in both number and lethality, we need to ensure that our systems will remain reliable, remain secure from cyber security threats, and that the Nation's ballistic missile defense capability and capacity keep pace with that threat.

We currently have 44 emplaced ground-based interceptors for Homeland defense. We plan to expand the fleet to 64 by 2023. In addition, improvements in sensor coverage to include the long-range discriminating radar in Alaska, the addition of a Homeland defense radar in Hawaii, if it is approved, and planning for a Homeland defense radar in the Pacific, as well as advanced discrimination improvements will enable the United States to improve protection of the Homeland.

The agency will also continue its Redesign Kill Vehicle development efforts, enhance the stockpile reliability program, and expand the ground-based interceptor battle space.

Integrated space and terrestrial sensors for cueing, tracking, discrimination, and targeting ballistic missile threats are critical to improving missile defense architecture robustness. This budget will continue to fund the space-based kill assessment demonstration program to deliver a capability to confirm intercepts for improved defense of the Homeland.

We are also continuing concept definition studies for space-based missile defense tracking sensors. If pursued, space sensors will be able to detect and track traditional and emerging threats as part of the BMDS [Ballistic Missile Defense System] architecture.

We will continue to install the Aegis ballistic missile defense weapon system on Aegis ships and deliver Standard Missile-3 Block IB interceptors. We're also supporting the European phase adaptive approach, providing coverage and protection of NATO [North Atlantic Treaty Organization] European territory populations and our deployed forces against the increasing ballistic missile threat from the Middle East.

Our request will support continued integration of the SM–3 Block IIA missile, a co-development effort with Japan into the Aegis ballistic missile defense weapon system, and the pre-production of all up-rounds to support the initial deployment for EPAA [European Phased Adaptive Approach] Phase 3.

Currently, there is an operational Aegis to shore site located in Romania, and while we have experienced delays in the military construction portion of the Aegis to shore effort in Poland, we remain steadfastly committed to delivery of that capability in support of EPAA Phase 3.

Finally, this budget request will continue the exploration of breakthrough technologies for integration into the BMDS, including discrimination improvements, multi-object kill vehicle technology, hypersonic defense technology, space-based interceptor technology,

and exploring higher-power lasers and interceptors that have potential use against threat missiles in a boost phase of flight.

As we evaluate the elements of the missile defense system, we will actively pursue developing elements that have multi-mission and Department-wide utility and leverage those systems once such activity with the F–35 that may have residual capability for missile defense.

Madam Chairman and members of the subcommittee, I look forward to answering your questions. Thank you.

[The prepared statement of General Greaves follows:]

[The information referred to follows:]

PREPARED STATEMENT BY LIEUTENANT GENERAL SAMUEL A. GREAVES

Good afternoon, Chairman Fischer, Ranking Member Donnelly, distinguished Members of the subcommittee. I appreciate this opportunity to testify before you today on one of the President's highest defense priorities for fiscal year (FY) 2019.

As I say it, the ballistic missile threat has voted and continues to vote today. Given this reality, the Administration has stated that we must take steps to respond quickly to counter the ballistic missile and nuclear weapons developed by our adversaries that are intended to kill Americans, and our allies and friends. To meet this pressing requirement, the President signed into law emergency appropriations requested in the Fiscal Year 2018 Budget Amendment that provided emergency funding to enhance the Nation's missile defense and defeat capabilities. I want to express my appreciation to the Congress for its support in this process. I am pleased to report that the Missile Defense Agency (MDA) is executing these funds with the utmost urgency. The President and the Department of Defense leadership have been very clear in outlining their priorities.

President Donald J. Trump stated on August 23, 2017: *"We are committed to expanding and improving a state of the art missile defense system to shoot down missiles in flight. And we are getting better and better at it. It's actually incredible what's taking place. We will develop better surveillance and long-strike capabilities to prevent our enemies from launching them in the first place."*

Secretary of Defense James Mattis, on September 20, 2017, warned the Department that *" . . . if we fail to adapt at the speed of relevance, ourforces will lose . . .*

The Chairman of the Joint Chiefs of Staff, General Joseph Dunford, Jr., USMC, on October 3, 2017 elaborated on the proximity and extent of the threat facing the United States when he stated: *"Based on the current capacity of the North Korean threat, both the type and the amount of missiles that they possess, we can protect Hawaii today against an ICBM. We can protect the continental United States against an ICBM . . . As the capacity of the threat increases—that is the size, not just the lethality, of missiles that they may possess—we need to be concerned about ensuring that our ballistic missile defense capability keeps pace with that threat. We do think an increase is warranted."*

And Ms. Ellen Lord, the Under Secretary of Defense for Acquisition and Sustainment, emphasized the importance of moving quickly through our processes to get the best and most advanced capabilities out into the field in a timely manner when she stated: *"It's all about velocity. We are trying to get stuff downrange quickly."*

The MDA mission is "to develop and deploy a layered Ballistic Missile Defense System to defend the United States, its deployed forces, allies, and friends from ballistic missile attacks of all ranges and in all phases of flight." The MDA budget request of $9.9 billion for fiscal year 2019 will continue the development, rigorous testing and fielding of reliable, increasingly capable, and state-of-the-art defenses for the United States, our deployed forces, and the forces and territories of our allies and partners against current and projected missile threats. This request will maintain current Homeland and regional missile defense assets and increase capability and capacity to keep pace with advancing threats. We will continue to collaborate closely with the warfighter and support the current and future needs of the combatant commanders with the development, testing, deployment, and integration of interceptors, sensors, and the command, control, battle management and communications (C2BMC) system into a multi-domain battle management and command and control system for the Ballistic Missile Defense System (BMDS).

MDA's fiscal year 2019 program plan aligns with the December 2017 *National Security Strategy* [1] and the 2018 *National Defense Strategy* [2] as well as the fiscal year 2017, fiscal year 2018 and fiscal year 2019 President's Budgets that lay out the path forward we are taking for missile defense. Last summer, I laid out three Agency priorities, support the Department's defense strategy, and guide the execution of missile defense program activities.

- First, *we will continue to focus on increasing system reliability to build warfighter confidence* by upgrading, improving, and sustaining deployed systems and executing a rigorous and continuous test and evaluation approach with strong modeling and simulations to mature technologies and validate deployed capabilities.
- Second, *we will increase engagement capability and capacity* by increasing the number of fielded interceptors, building out the sensor architecture with the aim of capturing "birth-to-death" tracking, improving system discrimination and integration, leveraging international partnerships for affordability and interoperability, and working closely with the Combatant Commands to provide integration support and capabilities to meet emergent operational needs.
- Third, *we will address the advanced threat* by working with Combatant Commands and Services to address emerging threats, to include the growing and highly challenging hypersonic glide vehicle and cruise missile threats and by pursuing advanced technologies, such as directed energy, and making prudent and affordable investments in potentially game-changing capabilities.

I can tell you today that the current BMDS meets today's threat, but we require additional capacity and advanced capability to stay ahead of the evolving threat, as is requested in the Fiscal Year 2019 President's Budget.

MISSILE THREAT

Nearly all of our adversaries are concerned with U.S. missile defenses and have devised various means to complicate missile defense operations. Missile defense countermeasures continue to be developed and fielded. Future supersonic/hypersonic powered cruise missiles may be launched by large rocket boosters that have traditionally been associated with ballistic missiles. Hypersonic glide vehicles are being developed as a new type of ballistic missile payload. The combination of high speed, maneuverability, and relatively low altitude makes them challenging targets for missile defense systems.

North Korea is committed to developing a long-range, nuclear-armed missile that is capable of posing a direct threat to the United States. In 2016 and 2017, North Korea conducted over 40 launches of short, medium, intermediate, submarine-launched, and intercontinental-range systems. This past February, North Korea paraded five ballistic missile systems: four of these received their first test launch in 2017. North Korea flight-tested two Hwasong-14 intercontinental ballistic missiles (ICBMs) in July. In their tested configuration, these missiles are capable of reaching North America. In late November 2017, North Korea launched what it described as a new ICBM-the Hwasong-15-which also demonstrated a capability to reach the United States. Pyongyang flew two Hwasong-12 intermediate-range missiles over Japan last year, placing our allies at potential risk from missile debris. The second of these tests demonstrated a capability to reach over 3,700 kilometers, which can range beyond Guam. The North twice flight-tested a solid-propellant medium-range missile capable of reaching Japan. Based on North Korea's developmental submarine-launched ballistic missile, this system-the Pukguksong-2 is the North's longest-range solid-propellant missile. This advancement is significant because solid-propellant missiles can be prepared for launch more rapidly than liquid-propellant systems. Additional missile launches out of North Korea—from short-range to intercontinental-range—are a near certainty. In addition to further strategic-weapon testing, North Korea has announced that it will focus on producing and deploying nuclear weapons and ballistic missiles in 2018.

Iran has ambitious ballistic missile and space launch development programs and continues to attempt to increase the lethality of its ballistic missile force. Iran is fielding increased numbers of theater ballistic missiles and improving its existing inventory. Its progress on space launch vehicles could shorten a pathway to an

[1] "The United States is deploying a layered missile defense system focused on North Korea and Iran to defend our Homeland against missile attacks." *National Security Strategy of the United States of America,* December 2017, p. 8.

[2] "Investments will focus on layered missile defenses and disruptive capabilities for both theater missile threats and North Korean ballistic missile threats." *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge,* p. 6.

ICBM. Iran's ballistic missiles are capable of striking targets throughout the region, ranging as far as southeastern Europe. It has used these missiles in the region, conducting retaliatory strikes on ISIS targets in Syria. Iran has steadily increased its ballistic missile force, deploying next-generation short- and medium-range ballistic missiles (SRBMs and MRBMs) with increasing accuracy and new submunition payloads. Iran is developing, and has publicized the testing of, SRBMs with anti-ship payloads. Iran also continues to proliferate ballistic missiles to states and non-state groups.

INCREASING SYSTEM RELIABILITY THROUGH TESTING, WARFIGHTER COLLABORATION, AND CYBERSECURITY

We continue to enhance the reliability and functionality of current missile defense systems, especially the Ground Based Interceptors and Aegis BMD Weapon System/Standard Missile (SM)-3 performance, build the confidence of warfighters in the BMDS, and work to reduce the number of interceptors needed to defeat in-flight ballistic missile threats. To increase system reliability and improve warfighter confidence in the system, MDA executes a fully integrated test program that synchronizes the system with the warfighters trained to operate the system under varying wartime conditions against current and emerging threats. This ensures BMDS capabilities are credibly demonstrated and validated prior to delivery to the warfighter.

MDA executes a continuous program to improve system reliability and manage service life of our BMDS components. An example is the Ground-Based Midcourse Defense (GMD) weapon system. A cornerstone of this effort is our stockpile reliability program (SRP) for Ground Based Interceptors (GBIs). Two GBIs have been removed from the fleet this past year, inspected, and tested to gain understanding of how the GBIs age in the silos. Another GBI will be removed this year for the SRP. From testing to date, we have been able to extend the service life of the Cl and C2 boosters. Another key effort is our Service Life Extension program. This program performs lifetime testing on key components in the kill chain enabling MDA to extend the service life beyond the manufacturer's estimate. This testing allows us to avoid unnecessary maintenance actions and control operations and support costs. MDA also pursues reliability improvements through our development activities. We measure availability and reliability data in the field and target improvements in the GBIs and GMD ground system development programs. A key delivery this year was Ground System 7A, which removed obsolete equipment from the kill chain, eliminated cyber defense vulnerabilities, and improved redundancy for the warfighter. Key future reliability improvements include delivering the Redesigned Kill Vehicle and upgrading the GMD Communications Network, launch support equipment, and the IFICS Data Terminal High Power Amplifier.

We continue to work closely with independent testers within the Department—the Director, Operational Test and Evaluation (DOT&E); Deputy Assistant Secretary of Defense, Developmental Test & Evaluation; Service Operational Test Agencies; Combatant Commands, and the Joint Forces Component Command for Integrated Missile Defense—to develop an Integrated Master Test Plan (IMTP) and execute a robust, cost-effective test program. The IMTP provides a flight- and ground-test program, to include rigorous modeling and simulation, systems engineering and validation, verification and analysis necessary to demonstrate and deliver proven integrated capabilities against the evolving threat.

MDA focuses on BMDS flight and ground testing that rigorously verifies, validates, and accredits models and simulations (M&S) to ensure confidence in the data used to make performance assessments. We use M&S in a robust integrated and distributed ground-test program. In 2018 MDA began the development of a high-fidelity, all-digital, integrated, BMDS-level simulation. This effort will combine the best performance assessment models from across all BMDS elements into an integrated simulation. The all-digital simulation will be able to model full BMDS architectures and excursions that cannot be easily explored in ground tests or flight tests for a more thorough exploration of the BMDS performance space. In fiscal year 2017, MDA successfully demonstrated a prototype of this digital simulation capability.

Our system ground-tests are the primary source for system performance data, and they test our capability across a wide range of threats and environments that cannot be replicated affordably in flight tests. The BMDS Operational Test Agency, which provides an independent operational assessment of the BMDS, relies heavily on the MDA ground-test program to assess independently MDA's operational capability. The ground-tests allow analysts to characterize BMDS performance under varying conditions, with unconstrained red and blue force limitations, and without the safety, fiscal, and hardware availability limitations of flight-testing. Addition-

ally, with warfighters on console, they are able to use ground-tests to refine Tactics, Techniques, and Procedures. All of the data from ground tests are used to inform DOT&E assessments of BMDS capability.

In addition to 14 element-level ground-tests, we conducted eight developmental and operational system-level ground-tests from October 2016 to present. There are two more system-level ground-tests scheduled for this fiscal year and five more planned for fiscal year 2019. Last year, we also conducted or participated in more than 20 multi-event exercises and wargames, which are critical to the Combatant Commands and the intensive engineering efforts across the Agency.

Flight-testing uses operational realism to provide data for M&S and demonstrates the performance functions of the system that ground-testing cannot address. One of the key attributes of each flight-test is combining the system under test with the soldiers, sailors, airmen, and marines that plan to operate the system in wartime under operationally realistic conditions. We also work closely with our allies to prove BMD capabilities are integrated and interoperable before they are fielded. From October 2016 to present, we have executed 22 flight-tests. For the remainder of fiscal year 2018, we will conduct seven more flight-tests, and in fiscal year 2019, 12 flight-tests, including the operational test of European Phased Adaptive Approach (EPAA) Phase 3 capabilities and the first salvo test using the Ground-Based Midcourse Defense (GMD) system. The Agency also is conducting detailed planning to conduct an Aegis BMD test against a long-range ballistic missile target and adding an IRBM target to GM CTV–03+ as risk reduction for the Homeland defense Redesigned Kill Vehicle (RKV) program. Both tests are planned for fiscal year 2020.

The warfighter is integrated into our requirements, engineering design/review and test efforts and processes. The Unified Command Plan assigns responsibility to the U.S. Strategic Command (USSTRATCOM) Commander to synchronize planning for global missile defense in coordination with other Combatant Commands, the Services, and appropriate U.S. Government agencies. USSTRATCOM, the central integrator for our requirements, defines the Integrated Air and Missile Defense (IAMD) Warfighter Involvement Process (WIP), which outlines the roles and responsibilities for all participants and establishes the structure for collaboration and advocacy for desired missile defense capabilities and characteristics on behalf of the warfighter. USSTRATCOM leads the WIP, advocates for the Combatant Commanders' desired IAMD characteristics and capabilities, and provides a Prioritized Capabilities List (PCL) of joint military capability needs to MDA and other appropriate acquisition authorities. The PCL informs MDA's President's Budget Request.

The *Capabilities Document for Homeland Ballistic Missile Defense,* accepted by the Joint Requirements Oversight Council (JROC) in 2014, baselined the current concept and prioritized future capabilities within the Homeland defense BMD system based on previously approved warfighter requirements, acquisition decisions, and current long-term investment strategy. This review included rigorous warfighter coordination and provided the opportunity to the warfighter to shape the document, which resulted in the JROC accepting the framework and Required Operational Attributes in the document. The Agency now uses those Required Operational Attributes as the requirements that guide capability development and future program capabilities necessary to make the system effective against threats in the future.

The objective of any development program is to provide effective warfighting capability to the hands of the warfighter as soon as it is technically and operationally feasible. Ultimately, the Services and Combatant Commands will operate and employ these capabilities as required. Upgraded Early Warning Radars, COBRA DANE, and Patriot are examples of systems or components that have successfully transitioned. Transitioning operations and sustainment to Services allows development agencies to re-focus RDT&E activities to address evolving threats. Terminal High Altitude Area Defense (THAAD) and AN/TPY–2 radar transition is in work with the Army and we are developing an agreement on the conditions and terms of transfer. Additionally, we are developing a plan for transition of Standard Missiles to the Navy, as is requested in the Fiscal Year 2019 President's Budget. MDA will continue to work within the Department on decisions to transfer capability to the Services. As transition is the end goal, each element and component will be evaluated against criteria such as its multi-mission potential; technical maturity; requirements and technical volatility; and interoperability with the overall system to determine the pace at which we will pursue transition.

MDA will also continue to provide the warfighter operational support by performing the routine mission essential functions of BMDS configuration control, asset management, and operational readiness reporting, providing an operational-level interface to United States Strategic Command, Northern Command, European Command, Central Command, and Pacific Command, and facilitating increased warfighter participation in development of future missile defense capabilities. MDA

will continue to provide support for systems like the globally deployed Aegis BMD/Standard Missile (SM)-3 system, AN/TPY–2 radar (Terminal and Forward-Based Modes), THAAD, and Command and Control, Battle Management and Communications (C2BMC). MDA also will continue to lead the integration of evolving MDA, Service, and COCOM command and control capabilities through systems engineering analysis and development of technical integration requirements and interface control documents to address the fielding of air, missile, and rocket capabilities by U.S. adversaries.

Getting work on contract and delivering capability as quickly as possible using the unique and broad set of authorities, responsibilities and accountability assigned to the Agency with balanced oversight from the Under Secretary (Research and Engineering) and Under Secretary (Acquisition & Sustainment) are critical to our ability to support the warfighter and accelerate program decisions and contract actions necessary to counter the rapidly evolving threat. As an example, MDA program offices are expediting activity to put new content on contract to deliver new capability to the warfighter after receiving $250 million in fiscal year 2017 reprogrammed funds and over $2.0 billion in emergency appropriations requested in the Fiscal Year 2018 Budget Amendment to support the Missile Defeat and Defense Enhancements (MDDE) initiative. Additionally, our centralized decision authority for program development and contract updates enabled more rapid incorporation of mandatory cybersecurity contract actions. New contract and program strategies, to include the proposed strategy for the Homeland Defense Radar—Hawaii (HDR–H), also are quickly approved and implemented.

Finally, the Missile Defense Agency is cognizant of the growing cyber threat and we continue to work aggressively to ensure the Nation's missile defenses are resilient and able to operate in a highly contested cyber threat environment. We are progressively improving the cyber hygiene of our missile defense capabilities by ensuring the cybersecurity infrastructure has the latest security upgrades. MDA remains focused on supporting the DOD Cybersecurity Campaign through implementation of the DOD Cybersecurity Discipline Implementation Plan—Four Lines of Effort for: Strong Authentication, Hardening of Systems, Reducing the DOD Attack Surface, and Alignment to Cybersecurity / Computer Network Defense Service Providers across all networks. These four lines of effort are critical to the defense of the MDA networks.

In addition to the four lines of effort, MDA has determined that protection of the Nation's BMDS unclassified data requires additional safeguards and enhanced vigilance. As part of these safeguards, MDA has engaged with our defense industrial base corporate partners to ensure cybersecurity is prioritized, addressed and enforced at all levels of the supply chain. The National Institute of Standards and Technology (NIST) has developed a Framework for Improving Critical Infrastructure Cybersecurity. This is a set of industry standards and best practices to help organizations manage cybersecurity risks. Measures include NIST control compliance, industry cybersecurity best practices as well as techniques for providing only the need-to-know unclassified BMD system data to each level of the supply chain. We continue to address industry compliance with applicable DFARs clauses associated with the protection of critical MDA controlled unclassified information and critical data.

Not only are we focused on external threats to our enterprise, but MDA acknowledges the reality of the insider threat as one of the more pervasive threats to be addressed, and we have established and implemented an aggressive Agency Insider Threat Program. This allows us to monitor both internal and external data movement to ensure all unclassified and classified data is handled in accordance with applicable guidance and is also afforded the highest level of protection. We are constantly evaluating our attack data and updating the MDA Emergency Response Team procedures. Abnormalities or violations are quickly identified and thoroughly investigated by both MDA and DOD Insider Threat and Counter Intelligence.

Finally, MDA is actively integrating cybersecurity requirements early into the acquisition life cycle to increase security and reduce overall cost. For example, we are upgrading C2BMC and the GMD ground systems software and hardware to enable enhanced cybersecurity protection capabilities. To better support our Combatant Commanders, this year we successfully executed the first DOT&E Cybersecurity Vulnerability & Penetration Assessment on BMDS platform systems culminating in a system-level assessment during Ground Test Distributed-07a. This is a significant step in understanding the cybersecurity posture of the BMDS and the ability to defend against emerging threats. We continue to develop a culture of cybersecurity knowledge and accountability across the Agency, which fosters awareness down to the user level to anticipate, detect, and respond to cyber issues before they can have an impact.

The MDA office of the Chief Information Officer, which conducts cybersecurity testing involving all the systems to include BMD elements, development labs, test systems to ensure the entire MDA Enterprise is secure, executes several testing efforts across MDA systems on an annual basis: 46 cybersecurity controls validation tests, 50 vulnerability assessments, and 110 software assurance code reviews, for a total of 1,030 test across the Future Years Defense Program (FYDP). MDA also executes BMDS element and system level tests that support fielding of new capability to be included in the Operations Capacity Baseline. Per section 1647 of the fiscal year 2016 NDAA, MDA is also responsible for MDA weapon system cyber testing and risk mitigation for the congressional report scheduled to be delivered first quarter fiscal year 2020. Over the FYDP there are over 211 cyber tests planned, including developmental and operational Cooperative Vulnerability and Penetration Assessments (CVPA) and Adversarial Assessments.

We have had a comprehensive ongoing effort since 2010 that I believe will go a long way in providing insight and proof of MDA's commitment to cyber protection and testing as a way of being responsive to DOT&E and working with them on the way-ahead. For example, as the cybersecurity threat has matured, the Terminal High Altitude Area Defense (THAAD) program identified the need to take a proactive approach to cybersecurity. The likelihood and consequence of the cyber-threat was increasing at a pace that necessitated programmatic change. After careful consideration, we created a comprehensive cyber program structure called the *THAAD Security and Networking Division.* This organizational structure is the foundation of THAAD's cyber security model and acts as the enabler for THAAD execution in all areas of cybersecurity. Cybersecurity includes compliance, security engineering, design, development, test, physical security and program security. The key to executing these roles is the understanding of the linkage that cybersecurity has with system engineering and the acquisition processes. By locating cybersecurity into THAAD's system engineering directorate, this aligns cybersecurity functions to the following other functions: software, modeling and simulation, future concepts, requirements, and system integration. This alignment not only ensures cybersecurity is inherit in the system engineering and development life cycles, it is the catalyst to increase THAAD's chances of survival in a cyber-contested environment. We believe this is a proven model that should be considered a best practice.

INCREASING ENGAGEMENT CAPABILITY AND CAPACITY

This budget request maintains operational missile defense capabilities for existing operational Homeland and regional defense forces and will continue to increase interceptor inventory capacity and use existing technologies to improve sensors, battle management, fire control, and kill vehicle capabilities to address evolving threats.

Homeland Defense

MDA remains committed to operating, sustaining, and expanding our Nation's Homeland missile defenses and requests $2.2 billion in fiscal year 2019 for the Ground-Based Midcourse Defense (GMD) program. We currently have emplaced 44 operational GBIs and, in accordance with the Fiscal Year 2017 Above Threshold Reprogramming and Fiscal Year 2018 Budget Amendment, plan to expand the fielded GBI fleet to 64 as early as 2023. This increase to GBI capacity is a response by the National Command Authority to the rapidly advancing North Korean threat and has been designated as an "emergency requirement" by the President in the Fiscal Year 2018 President's Budget Amendment.

The Agency will continue to demonstrate improved performance through flight- and system-ground testing of Homeland defenses, integrate additional capabilities provided by the Long Range Discrimination Radar (LRDR), BMDS system track, and Homeland Defense RadarHawaii (HDR–H), plan for a Homeland Defense Radar—Pacific (HDR–P), continue Redesigned Kill Vehicle (RKV) development, enhance the Stockpile Reliability Program, and expand the GBI battle space. We will continue improving our sensors, C2BMC, GMD ground systems hardware/software upgrades, GMD Fire Control (GFC), and kill vehicle software to improve discrimination capabilities and overall system performance. We also will continue to improve confidence in our reliability through increased testing and analysis.

At the same time, MDA is evaluating the technical feasibility of the capability of the SM3 Block IIA missile, currently under development, against an ICBM-class target in accordance with Congressional legislation. If proven to be effective against an ICBM, this missile could add a layer of protection, augmenting the currently deployed GMD system. As directed by the fiscal year 2018 NDAA language, we will conduct this demonstration no later than December 31, 2020.

Increasing GBI Capacity

In 2013, the Secretary of Defense directed MDA to expand the GBI fleet from 30 to 44 by the end of 2017, in response to provocations from North Korea. The GBI is the Nation's primary defense against long-range and intercontinental ballistic missiles. In November 2017, MDA emplaced the 44th GBI at Fort Greely, Alaska (FGA). Achieving this objective required MDA to purchase and field 14 additional GBIs. It also required refurbishment of Missile Field-1 to remediate obsolete hardware, update silo interface equipment, install a hardened mechanical electrical building, and upgrade related mission support systems infrastructure. To support the 44 GBIs within the existing system, MDA also upgraded GFC and ground systems.

Leading up to the fielding of 44 GBIs, MDA conducted three successful flight tests. Flight Test Ground-Based Midcourse Defense (FTG)-06b, conducted in June 2014, demonstrated long interceptor time-of-flight and Capability Enhancement (CE)-II Exo-atmospheric Kill Vehicle (EKV) capability to discriminate targets and intercept lethal objects from a representative target scene with countermeasures. A controlled test vehicle flight test, GM CTV–02+, conducted in January 2016, evaluated CE–II EKV performance with the newly designed Alternate Divert Thrusters in a non-intercept flight environment while allowing data collection to evaluate system enhancements, advanced discrimination algorithms, and salvo intercept time spacing.

FTG–15, conducted in May 2017, demonstrated viability of the new 3–Stage Configuration 2 (C2) booster and CE–II Block I EKV GBI. This was the first ever intercept of an ICBM-class target. The FTG–15 flight test successfully demonstrated our Homeland defenses GMD's systems functioned as predicted against a realistic threat ICBM-range target. The upgraded CE–II Block 1 EKV launched on a C2 booster successfully intercepted and destroyed a target designed to emulate a projected North Korean threat. FTG–15 proved effective engineering and manufacturing of the new GBI as well as improved discrimination algorithms, missile defense architecture and warfighter command and control.

MDA is developing the capability to provide the warfighter the option of either flying GBIs using all three booster stages or not igniting the third stage, providing performance similar to a 2-stage boost vehicle. This approach will provide additional Homeland defense battle-space capability through shorter engagement times without the expense of a separate 2-stage boost vehicle development program. This capability is planned to be tested in calendar year (CY) 2019, after which it will be fielded on all boost vehicle configurations.

Redesigned Kill Vehicle

The Redesigned Kill Vehicle (RKV) will improve reliability and make Homeland defenses more robust. The RKV will help address the evolving threat, enhance kill vehicle reliability, improve in-flight communications to better utilize off-board sensor data, and heighten Combatant Commanders' situational awareness via hit/kill assessment messages. The program leverages the SM–3 Block IIA kinetic warhead electronic and seeker to provide commonality among Agency interceptors, which is expected to lower costs, reduce risks and increase the speed of technology development and fielding of the RKV. The program schedule will conduct its first controlled test vehicle flight test of the RKV in fiscal year 2020 (GM CTV–03+). The first intercept flight test (FTG–17) is planned for fiscal year 2021 with a second intercept flight test (FTG–18) in fiscal year 2022. We anticipate deploying the RKV beginning in the fiscal year 2022 timeframe.

In 2018 MDA is initiating the GMD portion of MDDE, which will field an additional 20 RKV-equipped GBIs at FGA. MDA will accelerate the RKV production deliveries, construct a new missile field (Missile Field 4) at Fort Greely, install 20 silos, and deliver an additional 20 GBIs tipped with RKVs. We will complete the GMD portion of the MDDE as early as 2023. In addition, MDA will initiate a plan to ensure that no less than 64 GBIs are available to the warfighter at all times. To accomplish this, MDA will add two silos to MF–1 at FGA and purchase six additional GBI boosters. The additional silos and boosters will enable MDA to deliver an RKV-equipped GBI prior to removing a GBI as we replace the CE–I Kill Vehicles currently in the fleet.

Ground System Upgrades

MDA is continuing with capability upgrades and technology modernization of key ground support and fire control systems components such as the GFC equipment, the GMD Launch Support System, Communications Network, and the In-Flight Interceptor Communication System Data Terminal. The capability upgrades include: GFC–Warfighter interface and logic improvements, 2-/3-stage selectable GBI battle

management, discrimination improvements, enhancements to the kill vehicle Target Object Map, and On-Demand Communications for the RKV. Ground system modernization will continue to mitigate obsolescence issues, improve cybersecurity resilience, increase GFC capacity for emerging threat complexity and raid size, reduce life-cycle cost, increase system reliability and operational availability, and simplify the insertion of future technologies.

Defense Sensors

We are investing in radars and developing advanced electro-optical sensors to achieve a diverse sensor architecture that will provide highly accurate midcourse tracking, discrimination and battle damage assessment. We are also leveraging Services' sensors to support the BMD architecture, for example, the Navy's new solid state SPY–6 radar on their Flight III destroyers, the Air Force F–35 Distributed Aperture System, and future Department of Defense and Intelligence Community space sensors. In this year's budget submission we highlight the continued development of the Long Range Discrimination Radar (LRDR) and Spacebased Kill Assessment (SKA) programs, which will improve system target discrimination and assessment capabilities. Improved sensor coverage and interceptor capabilities will help the warfighter expand the battle space to reengage threats as needed.

We request $176.1 million to sustain Cobra Dane, the Upgraded Early Warning Radars (UEWR), and the Army Navy/Transportable Radar Surveillance and Control Model-2 (AN/TPY–2) radars. The Services and Combatant Commands, with logistical support from the MDA, operate a fleet of five AN/TPY–2 (Forward Based Mode) radars in Japan, Israel, Turkey, and United States Central Command in support of Homeland and regional defense.

We request $220.9 million to continue the development of advanced discrimination algorithms for the AN/TPY–2, Sea-Based X-Band (SBX) radar, and the UEWRs to counter evolving threats. The discrimination improvements will develop and field integrated capabilities to improve the BMDS ability to identify lethal and non-lethal objects. Beginning in fiscal year 2018, MDA will complete transition to production design activities for next generation Gallium Nitride Transmit/Receive Integrated Multichannel Modules to support the AN/TPY–2 obsolescence and sparing strategy and set the condition for enhanced performance in the future. MDA requests $81.0 million for Ballistic Missile Defense (BMD) Sensors testing activities for planning, analysis, and execution of BMDS flight test events, including pre- and post-test efforts, such as Digital and Hardware-in-the-Loop Pre-Mission Tests, and Post-Flight Reconstruction.

MDA requests $149.7 million for the SBX radar. The SBX is an advanced mobile radar that provides precision midcourse tracking and discrimination capabilities. The SBX participates in flight tests to demonstrate discrimination and debris mitigation improvements. To address the continued missile test activity of North Korea, our budget request includes funds to extend time at sea and conduct contingency operations for defense of the Homeland in the United States Pacific Command and United States Northern Command areas of responsibility.

We request $164.6 million to continue development of the LRDR. The LRDR is a midcourse sensor that will provide persistent long-range midcourse discrimination, precision tracking, and hit assessment and improve BMDS target discrimination capability while supporting a more efficient utilization of the GMD interceptor inventory. LRDR also will support additional mission areas, including Space Situational Awareness. The LRDR site will be constructed as two separate military construction projects. For fiscal year 2017, Congress fully funded Phase 1 of the LRDR project by providing $155 million for a Shielded Mission Control Facility and Radar Foundation. MDA began military construction of Phase 1 in fiscal year 2017. Phase 2 in fiscal year 2019 will address the shielded Power Plant that includes fuel storage, a maintenance facility, and associated site support. Initial fielding of the LRDR is on schedule for first quarter calendar year 2020. We are on-schedule for the Technical Capability Declaration in late third quarter or early fourth quarter fiscal year 2021, leading to Warfighter Operational Readiness Acceptance in fiscal year 2022.

The Sensors Analysis of Alternatives (AOA), conducted by the Department to assess the most cost-effective options for enhanced sensor capability to increase Ground Based Interceptor effectiveness against future, complex threats, highlighted the operational value of placing additional discrimination radars in the Pacific. Based on the Sensor AOA finding, MDA completed site surveys for the Homeland Defense Radar-Hawaii (HDR–H) in fiscal year 2017. We requested $21 million in fiscal year 2018 for the HDR–H to conduct source selection activities and award this radar as the first delivery order on a fixed-price indefinite delivery/indefinite quantity (IDIQ) contract. MDA is requesting $62.2 million in fiscal year 2019 for the HDR–H. In addition, MDA plans to complete site surveys in fiscal year 2018 and

competitively award the Homeland Defense Radar-Pacific (HDR–P) by the end of fiscal year 2019 as the second delivery order on the IDIQ contract. MDA is requesting $33.5 million in fiscal year 2019 for the HDR–P. Both radars will close coverage gaps in the Pacific architecture and provide persistent long-range acquisition and midcourse discrimination, precision tracking, and hit assessment to support the defense of the Homeland against long-range missile threats.

Space provides the critical vantage point necessary to address rapidly advancing threats across multiple regions of interest and the only vantage point for global persistence to address warfighter requirements. A space-based sensor layer would enable the United States to use interceptor inventory more efficiently and effectively to counter a broad array of threats. Integrated space and terrestrial sensors for tracking, discriminating, cueing and targeting ballistic missile threats can improve missile defense architecture robustness.

We are requesting $16.5 million for the Spacebased Kill Assessment (SKA) program. Using fast frame, infrared sensors, SKA will deliver a kill assessment capability for GMD defense of the Homeland as part of an integrated post intercept assessment solution requested in the Fiscal Year 2014 NDAA. SKA is MDA's pathfinder program to deliver a resilient sensor network in a rapid and affordable manner. Ground segment participation in BMDS flight tests occurred last year; on-orbit deployment of the sensors occurs this year; and we are looking at steps to add SKA to the operational BMDS when SKA proves itself during flight testing next year.

Also, we request $37.0 million for continued operation of the Space Tracking and Surveillance System (STSS) and the Missile Defense Space Center (MDSC) in fiscal year 2019. STSS satellites, which were launched in 2007, have exceeded their life expectancy and have proven to be a good investment. These satellites operate in low earth orbit and continue to collect valuable test data. The STSS program and the MDSC support concept development activities for future space sensor architecture studies and analyses to address advanced threats.

MDA is currently conducting trade studies and prototype concept design for a potential space-based missile tracking sensor/system. MDA envisions a space-based sensor architecture designed to detect and track traditional and emerging threats using persistent infrared sensing. If pursued, space sensors could be a key element of an integrated and layered BMDS Sensor Architecture. MDA could partner with the U.S. Air Force on requirements definition. MDA also envisions partnering opportunities with the Air Force on ground services, integration, launch, and operations. MDA will leverage the Enterprise Capabilities developed collaboratively between other DOD and federal agencies.

Regional Defenses

There are hundreds of ballistic missiles within range of U.S. forces and allies worldwide. Our fiscal year 2019 budget request continues to resource and build integrated regional missile defenses that are interoperable with systems deployed by international partners to protect deployed forces, allies and international partners against SRBMs, MRBMs, and IRBMs.

Terminal High Altitude Area Defense

Terminal High Altitude Area Defense (THAAD) is a transportable, ground-based missile defense system that defends against short- , medium-, and intermediate-range ballistic missiles in the terminal phase of flight. THAAD provides Combatant Commanders a rapidly deployable capability to deepen, extend, and complement BMDS Homeland and regional defenses. THAAD is now 15 for 15 in flight testing. MDA is conducting New Equipment Training for the 7th Battery, which will be ready for operational support to the Army later this calendar year. MDA also continues to deliver interceptors for the U.S. inventory. We have successfully fielded two THAAD batteries for a Foreign Military Sales case with the United Arab Emirates (UAE), and continue to deliver interceptors for the UAE inventory and provide maintenance and sustainment support.

Continued provocations demonstrate the serious threat North Korea poses to the Republic of Korea (ROK), the Asia-Pacific region, and United States forward-deployed forces. MDA continues to provide maintenance and supply support of the THAAD battery (including the Terminal Mode AN/TPY–2 radar) stationed in Guam. MDA is strengthening the capability of this regional BMDS presence in response to a United States Forces Korea Joint Emergent Operational Need (JEON) to increase integrated missile defense system interoperability and expand the defended area. This requirement is supported by USSTRATCOM and approved by the Chairman of the Joint Chiefs of Staff (CJCS).

U.S. Pacific Command initiated the deployment of the THAAD system to the ROK on March 6, 2017, implementing the United States-ROK Alliance's July 2016 deci-

sion to bring the defense capability to the peninsula. In coordination with the Army's Lower Tier Program Office, MDA began a concerted effort in May 2017 to develop an integrated, phased approach to incrementally field capability, delivering improved BMDS capability to the Korean Peninsula, including integration of existing BMD assets to improve engagement options and coverage. The deployment of THAAD contributes to a layered missile defense system and enhances the United States-ROK Alliance's defense against North Korean missile threats.

At OSD direction, the Army and MDA developed a draft Memorandum of Agreement (MoA) for the transfer of the THAAD and AN/TPY–2 programs from MDA to the Army. The draft MoA stipulates that when THAAD transfers to the Army, production operations and sustainment program and funding for THAAD and AN/TPY–2 systems would transfer to the Army, and Research and Development program funding of THAAD and AN/TPY–2 radars would remain in MDA. The MDA was approved by MDA and is currently being reviewed by the Army.

MDA requested $214.2 million in fiscal year 2019 for THAAD development efforts. We will continue development of THAAD software upgrades to address threat packages and defense planning as well as improved capability to engage SRBM, MRBM, and limited IRBM threats. THAAD development and integration will provide enhanced debris mitigation capability, improved interoperability with other BMDS elements, and expanded defended area footprints via remote operation of THAAD Launchers, as well as complete developmental efforts to upgrade and ensure the integrity and availability of positioning, navigation, and timing data for the THAAD weapon system. Finally, we will continue development efforts associated with USFK JEON that provide enhanced THAAD capability against specific USFK threats, improved radar energy allocation, improved THAAD performance against debris and in complex environments, and an accelerated initial capability to remote launchers and increase defended area.

Flight Test THAAD–18 (FTT–18) was conducted in Kodiak, Alaska on July 11, 2017. This test demonstrated THAAD's intercept of an IRBM-class target and THAAD's ability to fire from two launchers. Flight Experiment THAAD–01 (FET–01) was conducted in Kodiak, Alaska on July 30, 2017, which collected critical performance data related to countermeasures. Additionally, THAAD successfully achieved an intercept against the target in that countermeasure environment.

MDA requests $874.1 million to continue procurement of THAAD equipment, including 82 THAAD Interceptors in fiscal year 2019. By the end of fiscal year 2019, MDA will deliver 60 additional THAAD Interceptors to the U.S. Army, for a total of 276 interceptors delivered. MDA requests $61.0 million for Terminal Defense Testing in fiscal year 2019. We also request $92.6 million of Operations and Maintenance funding to support the maintenance and upkeep of all BMDS-unique items of the fielded THAAD batteries and for all THAAD training devices. In fiscal year 2018 MDA will provide support to seven THAAD batteries, including the two forward batteries stationed in the U.S. Pacific Command's area of responsibility and is prepared to support the U.S. Army in any future deployment around the world.

Aegis Ballistic Missile Defense

Aegis BMD continues to be a key component of the Nation's regional defense for our deployed forces, allies, partners and friends, and directly supports and expands our Homeland defenses with long range surveillance and track capability. The fiscal year 2019 budget request of $767.5 million supports continued advancement of the system to counter the growing threats.

In fiscal year 2017 we completed one Aegis BMD Weapon System installation on an Aegis ship: Aegis BMD 3.6 to Aegis Baseline (BL) 9.C1 (BMD 5.0CU) upgrade. We also initiated two Aegis BMD Weapon System installations on Aegis ships: one Aegis BMD 3.6 to Aegis BL 9.C1 (BMD 5.OCU) upgrade and one non-BMD capable ship to Aegis BL 9.C1 (BMD 5.0CU) upgrade. In fiscal year 2018 we began an additional eight Aegis BMD Weapons Systems installations on Aegis ships: six Aegis BMD 3.6 to 4.X, and two non-BMD capable ships to Aegis BL 9C.2 (BMD 5.1). We also retired the BMD 4.0.2 baseline in fiscal year 2017. We will retire BMD 4.0.3 through upgrades to BMD 4.1 in fiscal year 2019. In fiscal year 2017, we delivered 55 Standard Missile –3 (SM–3) Block IB missiles. Additionally, in fiscal year 2018, we plan to deliver 35 SM–3 Block IB production rounds to the Fleet.

In fiscal year 2019, as part of our overall Aegis BMD request we are requesting $232.92 million for the SM–3 Block IIA Program. This includes the continued integration of the SM–3 Block IIA into the BMD Weapon Systems, as well as pre-production All-Up-Rounds to support the initial deployment for EPAA Phase 3. In February 2017, we completed SFTM–0I, a successful developmental flight test, to demonstrate an organic intercept of a MRBM-class target with an SM–3 Block IIA missile from an Aegis Baseline 9.C1 Ship. This was the first intercept flight test of the

SM–3 Block IIA missile, which is a cooperative development program with Japan, and supports the initial production decision for the SM–3 Block IIA and the Aegis BL 9.C2 (BMD 5.1) certification effort, which will certify in 2018. In June 2017, with the execution of SM–3 Block IIA Cooperative Development (SCD) Flight Test Mission (SFTM)–02, we conducted a second SM–3 Block IIA missile flight test using an Aegis Baseline 9.C2 ship. Although this second test did not result in an intercept of the MRBM target, significant accomplishments were still achieved. A Failure Review Board (FRB) determined that an operator's actions at a console resulted in early termination of the SM–3 Block IIA missile in flight.

In January 2018, FTM–29 was conducted with a primary objective to intercept an air-launched IRBM-class target with an SM–3 Block IIA missile. While an intercept was not achieved, FTM–29 successfully demonstrated the ability of the Aegis Weapon System to receive and process remote link track via Command, Control Battle Management, and Communications (C2BMC) from the AN–TPY 2 radar, confirming Engage on Remote functionality. It also resulted in the first launch of a SM–3 Block IIA missile from the Aegis Ashore Missile Defense Test Complex (AAMDTC) at PMRF in Hawaii, which is important for EPAA Phase 3 Aegis Ashore sites in Romania and Poland as well as the potential procurement of Aegis Ashore by the Government of Japan. An FRB is investigating the cause of the failure and unmet objectives will be addressed in future flight testing.

In October 2017, Formidable Shield (FS)–17 was conducted with our NATO allies. This exercise included a successful intercept test of an SM–3 Block IB Threat Upgrade (TU) missile against an MRBM-class target, fired from an Aegis BMD destroyer at the United Kingdom Ministry of Defence Hebrides Range in Scotland, which resulted in the successful transition to full rate production for the SM–3 Block IB TU. This test was a mandatory prerequisite to the full production decision for the SM–3 Block IB Program, which was approved in December 2017. As a result of the full production decision, MDA is requesting 5-year Multi-Year Procurement (MYP) authority for the SM–3 Block IB interceptor for fiscal year 2019 to fiscal year 2023.

In fiscal year 2019, we will conduct Flight Test Operation-03 Event 1 (FTO–03 E1), where two SM–3 Block IIA missiles will simultaneously engage two IRBM-class targets, with one fired from Aegis Ashore Missile Defense Test Center (AAMDTC) at PMRF and the other from a U.S. Navy destroyer. This will demonstrate operational realism in an Engage on Remote (EoR) test scenario for ship launched missiles as well as those launched from operational Aegis Ashore sites in Romania and Poland.

We are strongly committed to further enhancing capability of the Aegis BMD system and continuing to improve the Aegis Weapon System in alignment with Navy requirements. In August 2017, we certified the Aegis BMD 4.1 computer program, delivering BMD 5.0CU capability with Sea Based Terminal defense with the SM–6 missile. We conducted CTV–03 following FS–17 on the Hebrides range, firing a SM–6 Dual I using Aegis BMD 4.1, providing the proper Objective Quality Evidence to certify firing this missile with this computer program. In fiscal year 2018, we will certify Aegis BL 9.C2 (BMD 5.1), that incorporates the SM–3 Block IIA missile and an EoR capability to meet European Phased Adaptive Approach (EPAA) Phase 3 requirements. In fiscal year 2018 we also plan to procure 34 SM–3 Block IBS and 20 SM–3 Block IIAs (16 SM–3 Block IIAs were requested in the fiscal year 2018 Missile Defeat and Defense Enhancement Budget Amendment and four SM–3 Block IIAs from the fiscal year 2018 President's Budget (PB) submission), and continue efforts on the installation of the Aegis Ashore Deckhouse and equipment in Poland.

In fiscal year 2019, we will continue our commitment to develop, test, and deliver global naval capability to the warfighter and support defense of our deployed forces and European NATO allies through delivery of EPAA Phase 3 missile defenses. MDA requests a total of $805.8 million in procurement for Aegis BMD, which plays a critical role in both Homeland and regional defense. As part of the overall Aegis BMD procurement request, MDA is requesting $411.68 million to procure 37 Aegis SM–3 Block IB missiles and $181.81 million to procure 6 SM–3 Block IIAs, along with associated hardware and support costs. By the end of fiscal year 2019, we plan to have 203 SM–3 Block IBS and 12 SM–3 Block IIAs in inventory. As the part of the procurement budget also requests $97.1 million for Aegis BMD Weapon Systems equipment. Also part of the request, we are asking for $115.21 million for advance procurement for economic order quantities and request permission to enter into a 5-year SM–3 Block IB Multi-Year Procurement (MYP) contract for fiscal year 2019 to fiscal year 2023. MDA will continue to deliver to the Navy SM–3 Block IBS and SM–3 Block IIAs once production has begun, for deployment on land at the Aegis Ashore site in Romania and at sea on multi-mission Aegis ships with BMD capability. In coordination with the U.S. Navy, we continue to expand the Fleet, and by

the end of fiscal year 2018 we anticipate having 38 ships (41 by the end of fiscal year 2019) equipped with the Aegis BMD weapon system.

The Navy is working with MDA to integrate the multi-mission Aegis BL 5.3 with Aegis BMD 4.1 into a single computer program. We are actively working with Navy to certify this capability in fiscal year 2020. MDA also continues collaboration efforts with the U.S. Navy on AN/SPY–1 radar antenna improvements that, when coupled with Aegis BL 5.4, increase radar detection sensitivity. We will continue to align ourselves with the Navy to develop and deliver a comprehensive Integrated Air and Missile Defense capability for the Arleigh Burke Flight III Destroyers, working towards a 2024 Initial Operational Capability. This Computer Upgrade will integrate BMD capability with the advanced Air and Missile Defense Radar (AMDR), also known as the AN/SPY–6, for remote engagements and increased raid capacity with simultaneous multi-mission capabilities.

Adding an additional layer to the Aegis BMD weapon system, we are using an incremental development approach integrated within the Navy's Baseline 9 architecture to develop and deliver a Sea Based Terminal (SBT) capability. By expanding the capability of the SM–6 missile and BMD 5 series weapon systems, we are delivering capability to maritime forces to protect against anti-ship ballistic missiles and provide layered defense for forces ashore.

We executed a non-intercept flight test, Flight Test Experimental (FTX)–21 in May 2016 involving the Aegis Sea Based Terminal defense of the fleet capability against an advanced threat representative target. The target, launched from PMRF in Hawaii, was the first flight of the MRBM-class Type 3 Phase 2 target. A U.S. Navy destroyer, an Aegis Baseline 9.Cl (BMD 5.0 CU) configured Arleigh Burke Destroyer, detected and tracked the target. This was a very important step in ensuring the safety of the fleet and demonstrating the Sea Based Terminal capability.

In December 2016, we conducted a detection, tracking, and intercept test (FTM–27) to further assess the capability of Sea Based Terminal Increment 1 in the Aegis Baseline 9.C1 (BMD 5.0CU) Weapon System. During this test we fired a salvo of two SM–6 Dual I missiles against the MRBM-class target launched out of PMRF. In this no-notice test, the sailors on the consoles aboard a U.S. Navy destroyer demonstrated the ability to conduct a critical terminal defense engagement in a ship-defense role. This was the first intercept test of this kind and it gave us greater confidence in the reliability and performance of our Sea Based Terminal defense capabilities. We conducted an additional test of the Sea Based Terminal Increment 1 capability in April 2017 (FTM–27 Event 2). During this test we fired a salvo of two SM–6 Dual I missiles against the MRBM target launched out of PMRF. In this no-notice test, the sailors on the consoles aboard a U.S. Navy destroyer again demonstrated the ability to conduct a critical terminal defense engagement in a ship-defense role. This test demonstrated improved SM–6 Dual I performance and further increased fleet confidence in the deployed SBT capability.

Sea Based Terminal Increment 2, which further improves our endo-atmospheric defensive capabilities, is on schedule to be certified and operational in the 2018–2019 timeframe. We conducted a successful Critical Design Review for ship defense in April 2017 for the SM–6 Dual II Sea-Based Terminal defense interceptor and conducted missile and weapon system integration testing in 2017. The first intercept flight test supporting Sea-Based Terminal Increment 2 is planned for first quarter of fiscal year 2019.

We continue to support the European Phased Adaptive Approach as a United States contribution to NATO BMD, providing coverage and protection of NATO European territory, populations, and forces against the increasing threat of ballistic missile proliferation in the Middle East. Currently, there is an operational Aegis Ashore site located in Romania. NATO's BMD architecture also includes the United States contributions of a forward-based AN/TPY–2 in Turkey, four BMD-capable Aegis destroyers homeported in Rota, Spain, SM–3 interceptors, and a command-and-control node at Ramstein Air Base, Germany.

In fiscal year 2018, we will continue our commitment to develop, test, and deliver global Naval capability to the warfighter and support defense of our deployed forces and European NATO allies through supporting the operational readiness of EPAA Phase 2 and efforts to deliver Phase 3 to improve defensive coverage against medium- and intermediate-range threats, which includes delivery of the Aegis Ashore site in Poland. Aegis Ashore site construction in Poland began in fiscal year 2016. That site will be equipped with the upgraded Aegis Baseline 9 weapon system with BMD 5.1 and a capability to launch SM–3 Block IIAs. This new SM–3 variant will support the EPAA Phase 3 technical capability declaration. The Aegis Weapon System upgrades are further enhanced by spiral upgrades to C2BMC and AN/TPY–2 sensors, enabling Engage on Remote capability and extended defensive coverage for NATO Europe.

Military construction (MILCON) delays due to an unsatisfactory rate of construction progress at the Aegis Ashore site in Poland will push the EPAA Phase 3 Technical Capability Declaration from December 2018 to CY 2020. Efforts by the Missile Defense Agency and the Army Corps of Engineers to mitigate the MILCON delays included creation of an onsite Poland Integrated Project Office to administer the MILCON contract and facilitate continuous and real-time assessment of the construction contractor's performance. Efforts also included the U.S. Government continuing to provide supplemental program leadership, subject matter experts and additional quality assurance personnel to Poland; proactive use of contractual incentives, establishment of joint weekly program updates with the MDA Director and Army Corps' North Atlantic Commanding General; and quarterly Flag and General Officer reviews onsite. Despite these efforts, by December 6, 2017, it became evident that it was no longer possible to mitigate MILCON delays through compression of, and concurrency between, the non-MILCON elements of the project. At that time, the government decided to rebaseline the project schedule given the likelihood of continued schedule erosion and the consumption of all margin. The rebaseline effort is on-going.

MDA fiscal year 2019 budget request includes $15.0 million in Defense Wide Procurement and $27.7 million in Research, Development, Test & Evaluation (RDT&E) funds to address the multiple actions required to field Aegis Ashore in Poland and continued operations of other Aegis Ashore sites. Given the MILCON delays and the requirement to be on-site for at least another year, MDA's fiscal year 2019 budget request includes funding to complete combat system adaptation, integration, installation, and testing to ensure delivery of EPAA Phase 3 capability to the warfighter. This capability ensures our ability to defend United States assets in Europe and meet EPAA Phase 3 commitment to our NATO allies. Given the successful efforts of controlling military construction costs, MDA does not anticipate a need to increase our MILCON budget in support of Aegis Ashore Poland.

Command and Control, Battle Management, and Communications and Regional Sensors

We request $475.2 million in fiscal year 2019 for the C2BMC. C2BMC provides persistent acquisition, tracking, cueing, discrimination, and fire-control quality data to Aegis BMD, GMD, THAAD, Patriot, and coalition partners to support Homeland and regional defense. We continue to support warfighter command, control and battle management needs across the globe by providing the Combatant Commander with the BMD planner, situational awareness tools, and battle management capability to support global BMD situational awareness, coalition operations, weapons release authority for Homeland defense, and control and tasking of forward-based AN/TPY–2 radars and the LRDR radar. C2BMC operators and maintainers deploy forward in some of the world's hottest threat spots and continue to provide around-the-clock support to the local commanders.

In fiscal year 2019, we will complete testing and deployment of C2BMC Spiral 8.2–3 and BMDS Overhead Persistent Infra-Red Architecture (BOA) 6.1, in support of EPAA Phase 3 / Aegis BMD Engage-on-Remote functionality. Initial deployments will be to U.S. Central Command and U.S. European Command followed by U.S. Northern Command and U.S. Pacific Command providing enhanced tracking capabilities to the warfighter. C2BMC also will initiate integration of a sea-based mobile sensor in the S8.2–3 timeframe that will provide enhanced tracking for emerging threats. We will continue development of C2BMC Spiral 8.2–5, which provides system level discrimination data, BOA 7.0 to provide advance threat warning capability, and threat characterization solutions and support command and control integration of the LRDR into the BMDS by 2021 to support a Robust Homeland Defense capability. C2BMC will initiate Increment 7 development tasks for command and control of the HDR–H radar and Robust Post Intercept Assessment supporting our Homeland defense focus.

We continue supporting incremental improvements to the BMDS to keep pace with emerging threats worldwide by investing in the development, integration and testing of advanced algorithms to improve track and discrimination capabilities and enhance the use of space-based sensor data from sources such as the Space Based Infra-Red System (SBIRS), using the BMDS OPIR architecture. C2BMC will update hardware/software to increase cybersecurity through implementation of the DOD Cybersecurity Discipline Implementation Plan—Four Lines of Effort. We are conducting over 63 cyber-focused C2BMC tests and assessments involving multiple agencies over the FYDP to ensure the system is cyber-secure.

Finally, MDA continues to support the AN/TPY–2 (Terminal Mode) radars as part of a forward-deployed Terminal High Altitude Area Defense (THAAD) batteries in Guam and the Republic of Korea.

International Cooperation

The fiscal year 2019 budget request includes funding for regional missile defense capabilities to protect deployed U.S. forces, reassure allies and partners, and build cooperative regional security architectures. MDA has engagements with over twenty countries and international organizations and is committed to expanding work with our international partners through joint analyses, partner missile defense acquisition decisions, cooperative research and development projects, deployment of BMD assets, Foreign Military Sales (FMS), and co-production efforts.

MDA continues to emphasize allied and partner investments in their own missile defense capabilities, which create more effective regional security architectures that complement U.S. regional missile defense capabilities. We continue to execute an FMS case with the United Arab Emirates for two THAAD batteries, including launchers, radars, and interceptors. Both batteries have been delivered to the UAE and have achieved Initial Operational Capability (IOC). MDA is actively engaged with several nations, particularly those in the Arabian Gulf region, to provide program information and cost data that may inform future decisions to procure THAAD and other missile defense systems. In 2016, MDA completed a regional Ballistic Missile Early Warning System architecture study for the Gulf Cooperation Council (GCC), analyzing sensor and C41 options for defense of the region. We are continuing to discuss the study's findings with the GCC nations. Additionally, MDA received a Letter of Request from the Kingdom of Saudi Arabia for seven THAAD batteries in April 2017. MDA is working with the Saudis to finalize the Letter of Offer and Acceptance.

MDA has a strong cooperative missile defense partnership with Israel through our continued work with the Israeli Missile Defense Organization. MDA's fiscal year 2019 request is consistent with the funding Memorandum of Understanding that the United States and Israel signed in 2016. This budget continues MDA's longstanding support of United States-Israeli Cooperative BMD Programs, to include the co-development and co-production of the David's Sling Weapon System and Upper Tier Interceptor, and improvements to the Arrow Weapon System. The Department continues to support co-production efforts for the Iron Dome program to provide critical defense against short-range rockets and artillery.

We continue to make progress with our Japanese counterparts on the Standard Missile-3 Block IIA (SM–3 Block IIA), our largest co-development effort, which supports extended deterrence and establishes an important vehicle for closer defense cooperation ties. The development work remain on track for first delivery of the missile in the 2018 timeframe. The United States will deploy the SM–3 Block IIA to the fleet and at Aegis Ashore sites to improve and expand defenses against MRBM and IRBM threats. We are committed to delivering the SM–3 Block IIA to meet global threat requirements and support EPAA Phase 3.

Our fiscal year 2019 budget request also supports Allied participation in tests, exercises, and wargames.

ADDRESSING THE ADVANCED THREAT

We must make investments in advanced technology today to prepare for tomorrow's threats by improving system performance and effectiveness. This budget request will continue the development of breakthrough technologies for integration into the BMDS, including discrimination improvements, Multi-Object Kill Vehicle technology, hypersonic defense technology, and high-powered lasers that have potential use against threat missiles in the boost phase of flight. We need to investigate solutions that reduce reliance on expensive kinetic interceptors. Scalable, efficient, and compact high-energy lasers could change future, missile defense architectures. By improving reliability, enhancing discrimination, and expanding battle space, I believe we can reduce the cost per kill. MDA is developing technology to address gaps in the BMDS and dramatically drive down the cost of defending the Homeland.

MDA requested $148.8 million for Technology Maturation Initiatives to conduct ground and airborne demonstrations of advanced sensor systems and refine directed energy technologies for missile defense. MDA is committed to developing and demonstrating directed energy and laser technologies that could be integrated into the BMDS, and we are actively testing a broad range of potential concepts, including both tracking and defensive lasers that could be deployed on a variety of platforms. Once we mature the required power, one potential concept the Agency is exploring is an Unmanned Aerial Vehicle-mounted laser that could destroy ICBMs in the boost phase at long standoff ranges. This concept requires precision tracking and a highly stable, lightweight, accurately pointed laser beam. We are currently testing a number of technologies to determine if this is a viable concept.

We are operating MQ–9 aircraft outfitted with passive sensors to help us understand boost-phase intercept tracking and how an airborne layer could augment our existing sensor network. In 2019, we will add tracking lasers to these aircraft to increase precision and range and determine how these compact lasers could further influence sensor design. In addition, we are developing advanced sensors and testing them from ground sites to improve discrimination accuracy and validate performance against targets of opportunity. What we learn from these ground and airborne tests could influence future space-based sensor systems.

We will complete three industry preliminary designs in 2018 of a multi-kilowatt class electric laser on a high-altitude airborne platform to demonstrate beam stabilization technology. In 2019 we will finish the design and begin fabrication of this first-of-a-kind system.

We continue to advance the state of the art for scaling electric laser power in efficient packaging. Both Diode Pumped Alkali Laser and Fiber Combing Laser technology have the potential to meet missile defense requirements. In 2019, we will concentrate on compact component development at the national laboratories and work with Industry and the Services to investigate other promising laser technologies. Based on the results of these and other tests, we will work closely with the Department to determine the best way to integrate directed energy and laser sensing into the missile defense system.

MDA requests $189.8 million for the Multi-Object Kill Vehicle (MOKV) effort to establish the technology foundation for killing multiple lethal objects from a single interceptor. The more kill vehicles we can put on an interceptor, the greater the raid capacity of our Ground-based Midcourse Defense system. MOKV has the potential to significantly enhance Homeland defense capabilities at a lower cost per engagement against the threat. MDA competitively awarded contracts to three major prime contractors in 2017 to reduce the technical risk for MOKV product development. The MOKV Technology Risk Reduction effort will culminate with demonstrations of hardware-in-the-loop prototypes. Our current plan is for an MOKV demonstrated capability in the 2027 timeframe.

We request $120.4 million in fiscal year 2019 for the Hypersonic Defense effort to execute the systems engineering process, identify and mature full kill chain technology, provide analysis and assessment of target of opportunity events, and execute near term space sensor technology and multi-domain command and control capability upgrades to address defense from hypersonic threats. This effort will execute the Defense Science Board's recommendations to develop and deliver a set of material solutions to address and defeat hypersonic threats informed by a set of near-term technology demonstrations. An integrated set of enhancements will provide incremental capability measured by progress and knowledge points in the following areas: establishment of systems engineering needs and requirements to identify alternative material solutions; execution of a series of sensor technology demonstrations; modification of existing BMDS sensors and the C2BMC element for hypersonic threats; and definition of weapon concepts and investments in key technologies to enable a broad set of solutions, including kinetic and non-kinetic means.

MDA requests $20.4 million for the Advanced Research Program to continue capitalizing on the creativity and innovation of the Nation's small business community and academia to enhance the Ballistic Missile Defense System. Advanced Research conducted research and material solution analysis to identify initiatives and technology to include missiles, sensors, and command and control components in the defense against current and future threats. We are fostering cutting edge research between U.S. and foreign universities of allied nations through international cooperative technology development projects.

We request $13.0 million for the Advanced Concepts & Performance Assessment effort, which centralizes advanced technology concept modeling, simulation, and performance analysis and delivers independent assessments of government, university, and industry technology concepts that, along with systems engineering requirements, support acquisition strategy decisions and define our technology focus areas.

We also will continue to support trade studies, systems engineering, modeling and simulation, and prototype design for a potential space-based missile defense-architecture.

CONCLUSION

Mr. Chairman and Members of the Subcommittee, in closing, our fiscal year 2019 budget funds comprehensive missile defense development efforts, including several critical capabilities required by the warfighter. We will continue to increase the reliability as well as the capability and capacity of fielded Homeland and regional mis-

sile defense systems and make measured investments in advanced technology to counter the adversary missile threat.

Based on the current capacity of the North Korean threat, both the type and the amount of missiles that they possess, we can protect the continental United States and Hawaii today against an ICBM. However, as the threat increases in size and lethality, we need to ensure that our systems are reliable and our ballistic missile defense capability and capacity keep pace with that threat. With its fiscal year 2019 President's Budget request, MDA will support the National Defense Strategy with the continued development and deployment of an integrated, layered missile defense system to defeat current and projected missile threats, allowing the Nation to compete, deter, and win.

We must evolve our missile defense capabilities to outpace growing and increasingly complex threats. The addition of another Fort Greely Missile Field and twenty GBIs to the operational inventory will address the increasing numbers of threat missiles we may have to counter against the Homeland. Sixty-four GBIs and urgent improvements in sensor coverage, to include the addition of a Medium Range Discrimination Radar and advanced discrimination improvements, will enable the United States to improve protection of the country. This budget request also will help grow the number of THAAD and SM–3 Block IB interceptors available to the warfighter to improve regional missile defenses.

Continuing the approach employed by my predecessors, I am completely committed to MDA's audit process to demonstrate our careful stewardship of the resources provided us. I am equally committed to MDA's full transparency in our engagements with the congressional defense committees, the Government Accountability Office, and Department's Inspector General.

I also would like to recognize the brave men and women who serve in our Armed Forces at home and abroad and who operate the BMDS. Our Nation is fortunate to have such a capable fighting force.

I appreciate your continued support for MDA and this critical mission, and I look forward to answering the committee's questions. Thank you.

Senator FISCHER. Thank you, General.

General Dickinson?

STATEMENT OF LIEUTENANT GENERAL JAMES H. DICKINSON, USA, COMMANDING GENERAL, UNITED STATES ARMY SPACE AND MISSILE DEFENSE COMMAND/ARMY FORCES STRATEGIC COMMAND AND JOINT FUNCTIONAL COMPONENT COMMAND FOR INTEGRATED MISSILE DEFENSE

Lieutenant General DICKINSON. Chairman Fischer, Ranking Member Donnelly, and other distinguished members of the subcommittee, thank you for your continued support of our soldiers, civilians, and their families. I'm honored today to testify before you to emphasize the importance of air and missile defense to our Nation, deployed forces, allies and partners.

Air and missile defense threats continue to increase both in quantity and offensive capability. With this in mind, I appreciate your continued support for the Nation's air and missile defense forces as we fulfill our role in securing the Nation today and developing future forces and capabilities to counter tomorrow's threats.

I'd like to briefly summarize the missions of the organizations I command.

First, United States Army Space and Missile Defense Command, Army Forces Strategic Command, SMDC/ARSTRAT, serves as a force provider in support of our combatant commanders. Our six priorities are to protect our Homeland; provide combat-ready forces and capabilities; plan and conduct synchronized global operations; prepare or adapt leap-ahead concepts and technologies; preserve and account for the Nation's critical resources; and promote and foster a positive command climate.

We provide not only air and missile defense forces but also Army space forces. The Army has more than 4,000 military and civilian space cadre providing continuous space-based capabilities and support to the warfighter around the world, from satellite communications to missile warning. SMDC/ARSTRAT's future warfare center and technical center develop space and missile defense concepts, requirements, and doctrine. We provide training to the Army space cadre and missile defense operators, and execute space and missile defense research and development.

Within SMDC/ARSTRAT, we are collaborating closely with the Army's air and missile defense cross-functional team. This effort is key to rapidly developing requirements and ensuring these future capabilities transition quickly from concept to prototyping to fielding. We are focusing on capabilities that include mobile short-range air defense and directed energy.

I also have the honor and the privilege to command the Joint Functional Component Command for Integrated Missile Defense, or JFCCIMD, which supports United States Strategic Command by integrating and synchronizing global missile defense operations.

In support of USSTRATCOM, JFCCIMD executes these five essential mission defense tasks: synchronizing operational-level planning; supporting ongoing operations; integrating training exercises and test activities globally; providing recommendations on the allocation of low-density, high-demand missile defense resources; and also advocating for future capabilities.

To accomplish this, we maintain close collaborative relationships with the geographic combatant commands, the Missile Defense Agency, the Office of the Secretary of Defense, the Joint Staff, and our allies and partners.

Lastly, it's important to highlight that the challenges that we face cannot be overcome without the dedication of our most precious asset, our people. The servicemembers, civilians and contractors, along with their families, stationed at home and globally deployed, provide support to the Army and joint warfighter each and every day. We are committed to providing trained and ready soldiers and civilians and developing effective space and missile defense capabilities to counter the threats of today and tomorrow.

I appreciate the committee's continued support of missile defense operations, and especially your support of the men and women who deploy, develop, and operate these complicated systems. I have addressed in detail the full range of these missions and how we are executing them today in my written statement which, as you said, will be submitted for the record. I look forward to addressing your questions. Thank you.

[The prepared statement of Lieutenant General Dickinson follows:]

PREPARED STATEMENT BY LIEUTENANT GENERAL JAMES H. DICKINSON

INTRODUCTION

Madam Chairman Fischer, Ranking Member Donnelly, and distinguished Members of the Subcommittee, thank you for your continued support of our servicemembers, civilians, and families. Let me express my appreciation to this Subcommittee for its continued support of the Army, the U.S. Strategic Command, the Department of Defense, and the missile defense community. I am honored to testify before this Subcommittee along with these distinguished witnesses who provide and utilize missile defense capabilities in defense of our Nation, forward deployed forces, partners, and allies.

I appear before you today bringing both a joint and Army perspective on effective missile defense capabilities. Within the Army and joint community, my responsibilities encompass several mission areas.

As the commander of the U.S. Army Space and Missile Defense Command and Army Forces Strategic Command (USASMDC/ARSTRAT) I have title 10 responsibilities to organize, train, and equip Army space and global ballistic missile defense forces. I serve as the Army's force modernization proponent for space, global ballistic missile defense, and high altitude forces and capabilities. Further, I am the Army Service Component Commander (ASCC) to U.S. Strategic Command (USSTRATCOM). I am responsible for planning, integrating, coordinating, and providing Army space and missile defense forces and capabilities in support of USSTRATCOM missions.

I also serve as the Army's Air and Missile Defense (AMD) Enterprise Integrator. My responsibility in this role is to synchronize the balanced execution of the Army's AMD strategy across the functions of force planning and sourcing requirements, combat and materiel development, AMD acquisition, and life cycle management. I coordinate with the AMD community of interest to balance priorities, inform resourcing decisions, and pursue innovative approaches in order to enhance our strategic flexibility.

Finally, as the Commander of USSTRATCOM's Joint Functional Component Command for Integrated Missile Defense (JFCC IMD), I am responsible for coordinating global missile defense planning, conducting missile defense operations support, recommending allocation of missile defense assets, and advocating for missile defense capabilities on behalf of the Combatant Commanders.

My first, second, and third major tasks within these roles can be summarized as providing forces and capabilities for current operations; preparing forces and capabilities for the future fight; and, research and development of Army technologies that will provide future advancements in air and missile defense capabilities. To achieve this, the organizations I command align their activities to these priorities:

- Protect our Homeland
- Provide combat-ready forces and capabilities
- Plan and conduct synchronized global operations
- Prepare or adopt leap-ahead concepts and technologies
- Preserve and account for the Nation's critical resources
- Promote and foster a positive command climate

My intent today is to highlight the dedicated people who serve in the diverse and geographically dispersed organizations under my command; to briefly outline the strategic environment; to emphasize USASMDC/ARSTRAT's missile defense force provider responsibilities with respect to the Army and the geographic Combatant Commanders (GCCs); to outline JFCC IMD's role as a warfighter advocate and supporting USSTRATCOM's coordinating authority for global missile defense planning; and finally, to summarize a few key Army AMD developments in the context of a comprehensive approach to addressing the evolving air and missile threat.

The Workforce-Our Foundation

USASMDC/ARSTRAT and JFCC IMD cannot carry out our wide-ranging national security missions without the dedication of our greatest asset—our people. One of my most important messages to you today is that your continued support is critical to our ability to develop and retain a highly qualified and mission ready workforce. The recent long-term budget uncertainty impacted our warfighters executing today's missions, as well as our ability to posture for the future. The servicemembers, civilians, and contractors who make up these commands support the Army and joint warfighter each and every day, in the Homeland and deployed across the globe. The budget agreement and the associated increase to the Department's top line budget is very helpful and will ensure we continue to provide trained and ready servicemembers and civilians to operate and pursue advancements in space and missile defense capabilities for our Nation. The extra resources will provide addi-

tional interceptor inventory capacity, modernize essential infrastructure, and enhance discrimination and assessment capabilities.

Soldiers, Civilians, and Contractors Working Together Across 11 Time Zones in 23 Locations to Protect Our Nation, Allies, and Deployed Forces

The Increasingly Complex Threat Environment

Current global trends indicate ballistic and cruise missiles are becoming more capable, due in part to the proliferation of advanced technologies, resulting in systems with global reach, increasing speed, and greater accuracy. Additionally, many foreign ballistic and cruise missile systems are progressively incorporating advanced countermeasures including maneuverable reentry vehicles, multiple independent reentry vehicles, and electromagnetic jamming, all intended to defeat our missile defense capabilities. Moreover, numbers of ballistic and cruise missile platforms are increasing. Many of these systems are mobile, which increases the difficulty in detecting, tracking, and engaging these weapons prior to launch.

Numerous countries are developing ground-, sea-, and air-launched land-attack cruise missiles (LACM) using a variety of unconventional and inexpensive launch platforms. Today, nearly 30 countries possess ballistic missile capability and some are actively pursuing hypersonic weapons. There are over 35 different variants of ballistic missiles in service across the globe today and a number of new intermediate-range and intercontinental ballistic missiles (IRBM and ICBM) are under development. North Korea has demonstrated rapid advances in range and overall missile performance. Since 2016, it has tested a submarine-launched ballistic missile, a new solid-fueled MRBM from a mobile launcher, a new IRBM, and its first ICBMs.

In the future, our missile defense systems will encounter more complex electronic and cyber-attacks, as well as directed energy threats that could significantly degrade U.S. missile defense operations. We expect cyber and electronic attacks will be increasingly relied upon in potential adversaries' anti-access/area-denial (A2/AD) strategies. Our ability to successfully counter these continuously advancing threats will rely heavily on our increased use of space and space-enabled capabilities. Space sensors could expand our capacity to track, discriminate, and successfully engage ballistic, cruise, and hypersonic threats.

In summary, adversary air and missile threats are proliferating in number and advancing in complexity. Our evolution of capability advancements requires a holistic approach that effectively integrates alternative capabilities to defeat air and missile threats. The strategic missile defense environment is becoming more challenging. Implementing technological advances in a time of fiscal constraints requires more cost effective methods to integrate our current and future capabilities. We continue to prioritize integrated AMD resources to optimize our support of the warfighter and to partner with the Missile Defense Agency (MDA), Combatant Commands, and the Services in pursuit of fiscally responsible methods to address evolving threats.

Strategic Positioning to Counter the Threat

To counter the threat and meet the objectives of the 2018 National Defense Strategy, USSTRATCOM and the U.S. Army continue to provide and enhance Homeland and regional missile defenses. We continue to work with our allies and partners in Europe, the Asia Pacific region, and the Middle East to increase integration and interoperability of missile defense systems and operations.

Integrated missile defense planning, force management, and operations emphasize global coordination with regional execution so that for any threat, we match the best interceptor with the best sensors. A holistic approach that integrates offense and defense will move the U.S. toward a more robust and flexible crisis response capability.

Over the last year, basing a Terminal High Altitude Area Defense (THAAD) battery in the Republic of Korea bolstered our regional defense capabilities to improve protection of U.S., allied forces, and critical infrastructure on the Peninsula. Additionally, during 2017, MDA completed the emplacement of 14 additional Ground-Based Interceptors (GBIs) at Fort Greely, Alaska to provide improved capacity to defend the Nation against an ICBM attack from North Korea, and potentially Iran in the future. The Nation now has a total of 44 GBIs and planning is underway to emplace an additional 20 GBIs in a new missile field at Fort Greely, Alaska as is reflected in the Fiscal Year 2019 President's Budget Request.

"I am confident the Ground-Based Midcourse Defense system can currently defend the United States from the threats posted by North Korea, but we must take prudent steps to remain in a position of relative technological advantage."

—USNORTHCOM SASC Posture Statement
February 2018

The 2018 National Defense Strategy prioritizes a strong commitment to security and stability in the lndo Pacific region, Europe, and the Middle East. In conjunction with our allies and partners, the Department of Defense maintains forward-committed Patriot, THAAD, and counter rocket, artillery and mortar (C–RAM) forces to enhance our AMD posture, sending a deterrence message to potential adversaries and assurance to our friends. We continue to work with regional partners and allies to increase information and data sharing and we are developing a more robust global AMD force posture that leverages partner nations' growing capabilities. This will result in reducing the strain on our forces while enabling more timely modernization of our AMD assets.

The Army AMD Enterprise is developing a new AMD strategy based on the National Security Strategy, National Defense Strategy, the pending Missile Defense Review, Army Operating Concept, the changing operational and threat environments, and the rapid pace of technological advancement. This new strategy, to be published later this year will focus on the 2018–2028 timeframe and align with current Department and Army doctrine. The updated strategy will address our ability to balance today's operational requirements while shaping the force and modernization efforts to counter future challenges. In addition, the Army's Modernization Strategy will enable us to deliver advanced air and missile defense capabilities to our warfighters on a substantially decreased timeline. The Air and Missile Defense Cross Functional Team is key to rapidly developing requirements and ensuring these future capabilities transition quickly from concept, to prototyping, to fielding. We are focusing on capabilities that include Mobile Short-Range Air Defense, directed energy, and advanced energetics.

Providing and Enhancing Missile Defense Capabilities

USASMDC/ARSTRAT's first major task is carrying out its title 10 responsibilities as a force provider of missile defense capabilities. This command is manned by multi component soldiers, civilians, and contractors, who contribute to operations, planning, integration, control, and coordination of Army forces and capabilities in support of USSTRATCOM's missile defense mission. Other commands around the world, including all GCCs, also leverage the capabilities we provide.

Our operational function in today's fight is to provide trained and ready missile defense forces and capabilities to the GCCs and the warfighter. For example, USASMDC/ARSTRAT soldiers serving in the Homeland and in remote and austere forward-deployed locations operate the Ground-Based Midcourse Defense (GMD) system and the Army-Navy/Transportable Radar Surveillance Forward-Based Mode (AN/TPY–2 FBM) radars. Highlights of the capabilities provided to current operations and readiness by our missile defense professionals include:

Support to Global Ballistic Missile Defense: Soldiers from the 100th Missile Defense Brigade, headquartered in Colorado Springs, Colorado, and the 49th Missile Defense Battalion, headquartered at Fort Greely, Alaska, are ready to defend our Nation and its territories from an ICBM attack. In support of U.S. Northern Command (USNORTHCOM), Army National Guard and Active component soldiers operate the Ground-Based Midcourse Defense Fire Control Systems located at the Fire Direction Center in Alaska, the Missile Defense Element in Colorado, and the GMD Detachment at Vandenberg Air Force Base, California. These soldiers, in conjunction with USNORTHCOM, also oversee maintenance of GMD interceptors and ground system components. At the Missile Defense Complex at Fort Greely, a remote site with limited community support amenities, 49th Missile Defense Battalion military police secure the interceptors and command and control facilities from physical threats. Given their strategic mission in this remote location, the harsh environment and 20-hours per day of winter darkness, we must continuously review and enhance the Fort Greely Garrison services and support to these soldiers, civilians, contractors, and their families. With the continued support of Congress, we

have already realized substantial quality of life improvements for these remotely-stationed personnel and their families.

> ***" . . . develop a state-of-the-art missile defense system to protect against missile-based attacks . . ."***
>
> —POTUS Statement
> Making Our Military Strong Again
> *January 2017*

Support to GMD System Test and Development: Soldiers from the 100th Missile Defense Brigade participate in GMD test activities and work with MDA developers on future improvements to the GMD system. MDA's testing regime, conducted through a series of ground-based and operational flight tests, and rigorously verified, validated, and accredited models and simulations, emphasizes operational realism during test design and execution. This realism enables soldiers of the 100th Missile Defense Brigade to gain tremendous training value and validate operational employment of the system. This contributes to readiness, by executing their actual operational tasks while providing warfighters with confidence the system will perform as designed.

Support to Regional Capabilities: The 100th Missile Defense Brigade also provides GCCs with trained and certified AN/TPY–2 Forward Based Mode (FBM) missile defense batteries (MDBs). These operational capabilities exist today at five strategic locations around the globe where they contribute to the early warning, cueing, tracking, and discrimination of threats to our allies and partners. These forward-based radars also represent a tangible contribution to both Homeland and regional defense. Soldiers manning these radars, deployed to remote and austere locations across the globe, persistently demonstrate our Nation's commitment to defend deployed forces, allies, and partners from ballistic missile attacks. MDA is the materiel developer for the AN/TPY–2 radars and, in accordance with the 2018 National Defense Authorization Act, is developing plans to transfer the program of record to the Army for continued operational sustainment.

Space Support to Ballistic Missile Early Warning: Space-enabled capabilities are essential for missile defense operations, providing and enabling communications, positioning, navigation, timing, intelligence, surveillance, reconnaissance, and early warning. We routinely coordinate and collaborate with USSTRATCOM's National Space Defense Center to ensure that the space assets are poised to support missile defense capabilities.

In support of the joint force commander, USASMDC/ARSTRAT continues to provide ballistic missile early warning within the U.S. European Command (USEUCOM), U.S. Central Command (USCENTCOM), and U.S. Pacific Command (USPACOM) theaters of operations. The 1st Space Brigade's Joint Tactical Ground Station (JTAGS) Detachments, which support the Joint Force Space Component Command (JFSCC), are operated by USASMDC/ARSTRAT space-professional soldiers who monitor launch activity and other infrared events. They provide essential information to members of the air, missile defense, and operational communities. Our JTAGS Detachments are forward deployed around the globe, providing continuous, dedicated, assured missile warning to USSTRATCOM and GCCs in support of deployed and forward-based forces. We continue to optimize this capability, and this year we gained support from the Government of Italy to relocate the JTAGS in Europe to Sigonella Naval Air Station. This will increase operational missile warning capability.

Space—The Ultimate High Ground

USASMDC/ARSTRAT's second major task is to build and mature future missile defense forces and capabilities. A major component of this function is providing relevant and updated training for our global missile defense systems. During the past fiscal year, USASMDC/ARSTRAT trained approximately 200 soldiers who execute the missile defense mission of the Homeland and our missile defense training courses earned USASMDC/ARSTRAT recertification as an Army Learning Institution of Excellence.

USASMDC/ARSTRAT, as a recognized Army Center for Analysis, also conducts studies to determine how to best meet the Army's assigned missile defense respon-

sibilities. Our analyses support the established and emerging processes the Army uses to document its missile defense needs and pursue joint and Army validation of its requirements. With insights from these studies, we develop and operationalize the Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities, and Policy (DOTMLPF–P) requirements to address evolving threats and potential vulnerabilities to the GMD and AN/TPY–2 FBM missile defense systems. This disciplined approach ensures limited resources are applied to achieve maximum operational utility.

Provide Combat Ready Forces and Capabilities

USASMDC/ARSTRAT's third major task is to provide critical technologies to address future needs that will enhance warfighter effectiveness. Our technology development function is primarily focused on the space and high altitude domains. Additionally, although MDA is the principal materiel developer for missile defense capabilities, USASMDC/ARSTRAT carries out supporting missile defense-related materiel development efforts, to include supporting research, development, and testing of an Office of the Secretary of Defense (OSD) sponsored conventional prompt strike capability. In addition to offensive capability development, we are also supporting MDA's concept development for defense against hypersonic threats. These technical capabilities are at the forefront of developing holistic, cost-effective approaches to address the broadening missile defense challenge. The following are brief summaries of two of our research and development efforts, as well as an overview of the capabilities of an essential Army testing range.

High Energy Laser Technology Development and Demonstration: The Army's high energy laser science and technology effort aims to develop ruggedized laser system components and subsystems, integrate them onto an Army vehicle, conduct demonstrations to characterize performance, and transition the technology to a Program Executive Office. A solid-state laser weapon system has the potential to be a low-cost and effective complement to kinetic capabilities in countering rockets, artillery, and mortars (RAM), unmanned aerial systems (UAS), and other threats. The effort builds upon earlier pathfinder demonstrations of a 10-kilowatt (kW) laser system by continuing to develop, integrate, and mature the technology at higher laser power outputs. The Robust Electric Laser Initiative (RELI) fiber laser was delivered to the Army in early 2017 and is being integrated into the High Energy Laser Mobile Test Truck (HELMTT) for a 50-kW laser demonstration against RAM and UAS threats later this year. This demonstration will be a key knowledge point for the next major phase of high energy laser technology development, the High Energy Laser Tactical Vehicle Demonstrator (HEL TVD). The HEL TVD supports the Army's Indirect Fire Protection Capability Increment 2-lntercept (IFPC Inc 2–I) program, discussed later in this document. It is on schedule to conduct a C–RAM 100-kW demonstration in late 2022 to validate system performance against IFPC Inc 2–I requirements.

USASMDC/ARSTRAT is also starting work this fiscal year on the Multi-Mission High Energy Laser (MMHEL) as an Army Technology Maturation Initiative (TMI). The TMI will integrate a 50-kW laser system on a Stryker platform and culminate in an operational demonstration that informs Maneuver-Short Range Air Defense (M–SHORAD) requirements. Supporting this effort is the Mobile Experimental High Energy Laser (MEHEL), a 5-kW laser on a Stryker. Over the past few years, MEHEL has participated in Maneuver Fires Integration Experiments and recently participated in a Joint Warfighting Assessment in Germany. MEHEL is helping warfighters develop tactics, techniques, and procedures, as well as concepts of operations for future high energy laser weapons.

Adapt Leap Ahead Concepts and Technologies

Low-Cost Target Development: The Army is engaged in a technology effort to develop a suite of threat-representative targets for lower tier missile defense testing at a substantially reduced cost. Over the past year, we completed three detailed target designs and successfully demonstrated two of the configurations, which leverage excess solid rocket motors. The first Sabre target was successfully launched and intercepted in June 2017, meeting all performance objectives. The second Sabre target was launched and successfully intercepted in November 2017. These missions were critical operational tests of the new Patriot interceptor. Development of a two-

stage ballistic missile target, known as Black Dagger, continues with a risk reduction launch scheduled for mid-2018. The Black Dagger target is meant to mimic a broader range of short-range ballistic missile threats by achieving longer range, higher altitude, and increased velocity. The Zombie suite of targets has missions planned for Patriot and Integrated Air and Missile Defense (IAMD) over the next few years. The goal remains to reduce DOD's overall test execution costs.

Missile Defense Testing Range: USASMDC/ARSTRAT operates the Ronald Reagan Ballistic Missile Defense Test Site (RTS). RTS, located on the U.S. Army Garrison—Kwajalein Atoll in the Republic of the Marshall Islands provides critical testing support to both offensive and defensive missile testing requirements for programs such as GMD and U.S. Air Force strategic ballistic missile systems. RTS retains preeminent ballistic missile testing capabilities used in validating the Nation's ability to sustain a strong, credible ballistic missile deterrent as a key element of national security and the security of U.S. allies and partners.

RTS supported 10 missile defense developmental flight tests in 2017. The Army conducted three of those tests with the Patriot system. MDA and the Army conducted two THAAD flight tests; MDA and the Navy conducted four test flights of the Standard Missile (SM–3 and SM–6); and MDA conducted one test of the Ground-Based Interceptor (GBI). Homeland and regional defense tests have grown ever more challenging and complex, providing a means to replicate missile defense architectures superimposed over this Pacific test site.

RTS also supports offensive ballistic missile testing for Air Force Global Strike Command. During fiscal year 2017, RTS supported four Minuteman III test launches to successfully validate and verify the effectiveness, readiness, and accuracy of the weapon system.

In concert with its testing mission, RTS conducts continuous deep space surveillance and space object identification operations to increase national capabilities and reduce expenditures for both mission sets. During the past year, the U.S. Air Force began construction of their most advanced surveillance system—Space Fence. In a few years, this improved surveillance capability will enable proactive space situational awareness while complementing existing systems at the RTS.

ARMY CONTRIBUTIONS TO THE NATION'S MISSILE DEFENSE CAPABILITIES

AMD is an enduring Army core function. AMD units serve as a key strategic enabler-an essential component of the Army mission to provide wide area security and support to joint campaigns. In addition to defense against ballistic missiles, the Army's current AMD strategy seeks to develop a more comprehensive portfolio of Integrated Air and Missile Defense (IAMD) capabilities. AMD is one of six Army modernization priorities and, as such, recent Army investments in missile defense have significantly increased. The Program Executive Office for Missiles and Space (PEO MS) is the Army's materiel developer for these capabilities and works closely with the other Services, the Joint Staff, and MDA toward joint IAMD capabilities. To ensure the mission of providing trained and ready Army AMD forces, we are engaged in developing an updated Army AMD strategy. A summary of the Army's AMD strategic direction and major programs follows:

Air and Missile Defense Readiness: Readiness is the Army's top priority, and the challenge to sustain the readiness of the total Army AMD force requires constant vigilance and senior leader focus. The operational demand to meet the requirements of joint warfighters continues to stress the Army AMD force, impacting both current and future readiness, as well as modernization initiatives. With over 50 percent of the AMD force either forward stationed or deployed, the Army continues to take action to mitigate this stress to the force and restore strategic flexibility. An Army Campaign Plan strategic effort to implement a Sustainable Readiness Model supports characterization of the challenge. A recent study on striking a balance between operational demand and modernization led to the activation of an AMD test detachment in fiscal year 2018. This study also supports normalization of AMD rotations to a 9-month cycle rather than the current 12-month cycle; we expect to achieve the shorter rotation cycle in the near future.

Mission Command: Closely linked to the challenge of sustaining AMD readiness is the ability to provide low density/high demand AMD mission command elements. The mission command elements are especially critical to support the integration of Army AMD forces into joint command and control architectures. Operationally, the Army recently activated a third National Guard air defense brigade headquarters assigned to the South Carolina Army National Guard to support mission command rotations for the National Capital Region integrated air defense mission. The Army completed the development and procurement of five Dismounted Patriot Information Coordination Centrals (DPICC) for the Army Air and Missile Defense Commands

(AAMDC), which mitigates the requirement to deploy a Patriot Battalion Headquarters element with each one- or two-battery deployment.

Army Integrated Air and Missile Defense (A/AMD): In addition to providing defense against ballistic missiles, the current AMD strategy continues to develop a more comprehensive portfolio of AIAMD capabilities to provide protection against other adversary threat systems and capabilities. The Integrated Air and Missile Defense (IAMD) Battle Command System (IBCS) integrates current and future AMD components into an Integrated Fire Control (IFC) system, provides a single integrated air picture, increases defended area, and provides flexibility in deployment. IBCS, the foundation for Army AMD modernization, is an Army priority. The program will field a common IFC system for Army AMD forces to defend against cruise missiles, manned and unmanned aircraft, air-to-ground missiles, tactical ballistic missiles, and RAM attacks. The IBCS network will operate with air surveillance and fire control capabilities across Services, and with coalition partners that provide joint warfighters with more decision space and lethality. When fielded, IBCS will enhance the lethality of the AMD force, breaking the current system-centric control paradigm, which will dramatically increase capability and also facilitate open industry competition in support of the AMD community. Additional efforts are currently underway to integrate the Army's IBCS and MDA's BMD System Command, Control, Battle Management, and Communications (C2BMC) to fully support IAMD interoperability with the ballistic missile defense system (BMDS).

As noted, the IBCS and indirect fire protection efforts will provide the future force with a capability to defend against a wide range of threats. Recent conflicts highlight the growing threat of UAS in support of tactical operations. They pose an increasing risk to the Army's combined arms team who are operating where the strategic and operational advantage of highly technical stand-off weapons have limited utility. Efforts are underway to close the risk gap to protect our maneuver forces with short range defense capability.

Patriot/Patriot Advanced Capability-3 (PAC–3) Missile Segment Enhancement (MSE): The Army Patriot force remains the cornerstone of AMD protection for our deployed forces, friends, and allies. GCCs' increasing AMD requirements drive the operational tempo and stress on the Patriot force. To meet requirements, reduce stress, and avoid adversary overmatch, the Army is improving Patriot capability against the near-term evolving threat while we move toward the IBCS architecture including the IFPC Inc 2–1 and a new Lower Tier Air and Missile Defense Sensor (LTAMDS).

Lower Tier Air and Missile Defense Sensor (LTAMDS): The LTAMDS program will provide sensing capabilities in the lower tier portion of the ballistic missile defense battlespace. LTAMDS will expand MSE battlespace, serve as a sensor node on the IAMD battle command system network, address capability gaps, modernize technology, reduce operations and sustainment cost, mitigate obsolescence, and increase reliability and maintainability. To enable the development of LTAMDS, the Army is leveraging the competitive nature of the Other Transaction Authority (OTA) to mature and integrate technologies, reduce risk, and to manufacture the LTAMDS.

Patriot must continually modernize through software and hardware upgrades to avoid obsolescence and to take advantage of the expanded battlespace afforded by the PAC–3 MSE interceptor. To counter the near-term threat, the Army is in the process of delivering the next Patriot software build, Post Deployment Build—8 (PDB–8). PDB–8 software provides combat identification enhancements, addresses upper tier debris mitigation, improves performance of the PAC–3 Missile Segment Enhancement (MSE) interceptor, and enhances Patriot and THAAD interoperability. To accelerate the modernization upgrades of the 35th Air Defense Artillery Brigade, the PBD–8 Urgent Materiel Release (UMR) was approved in July 2016. Initial Operational Test & Evaluation (IOT&E) was completed in September 2017, and the PDB–8 Full Materiel Release is planned for later this year.

Terminal High Altitude Area Defense System (THAAD): THAAD, a key component of the BMDS architecture, is designed for area defense of deployed and allied forces, population centers, and critical infrastructure against short-, medium-, and intermediate-range ballistic missiles. THAAD is a mobile and globally transportable, low density/high demand asset. A fully operational THAAD battery consists of 95 soldiers, an AN/TPY–2 radar, six launchers, a fire control and communications element, a battery support center, and a support element. THAAD has a unique endo- and exo-atmospheric intercept capability using proven hit-to-kill technology. There are now six available THAAD batteries, and a seventh will be operational by the end of 2018. As noted earlier, THAAD batteries are deployed to Guam and the Republic of Korea in response to the North Korean nuclear and missile threat.

Indirect Fire Protection Capability Increment 2—Intercept Block 1 (IFPC Inc 2–I): As the end of the operational lifecycle approaches for short-range AMD capabilities such as Avenger, the Army is developing new capabilities to defeat air threats. The IFPC Inc 2–I, currently under development, is a mobile, ground-based AMD weapon system designed to provide 360-degree protection against cruise missiles and UAS threats for fixed and semi-fixed sites, with the capability to launch multiple missile types. A block acquisition approach is being used to provide this essential capability. The Block 1 baseline system, consists of a new Multi-Mission Launcher (MML), an existing Sentinel A3 radar, and multiple missile types, integrated with IBCS. An engineering demonstration of the IFPC system was successfully completed in March 2016, which effectively used four different interceptors. The Block 1 baseline system, providing counter-UAS/cruise missile capability, is slated to begin fielding in fiscal year 2021. A second missile will be added to provide an initial C–RAM capability beginning in fiscal year 2023. The Block 2 System will provide a full C–RAM capability. This capability could be achieved by fiscal year 2028 for a kinetic energy solution and by fiscal year 2032 for a directed energy weapon.

Army Low-Cost Portable Surveillance (ALPS): The ALPS passive sensor will integrate into the IBCS network and provide continuous, 360-degree, long-range surveillance against fixed and rotary wing aircraft, UAS, and cruise missile threats.

Maneuver-Short Range Air Defense (M–SHORAD): The Army is increasing capabilities to address increasing short-range air threats to our deployed forces and allies. Plans are in execution to expand M–SHORAD capabilities, not only with additional forces but also with new equipment, especially in the European theater. Per Army Chief of Staff direction, we have fielded Stinger teams to protect maneuver forces and are on schedule to deliver two Avenger battalion equipment sets to USEUCOM this year in support of the European Deterrence Initiative. The equipment will be followed by personnel and infrastructure resulting in an Active component Avenger Battalion next year. We are also exploring the feasibility of procuring an interim M–SHORAD capability. Fielding of four M–SHORAD battalions is slated to occur over fiscal years 2021 and 2022. While the current M–SHORAD systems, Avenger and Stinger missiles, provide capabilities today, we must develop and field more advanced systems to outpace the threat. In addition to IFPC, continued R&D investments in lasers, high power microwaves, and electronic warfare are essential to increase M–SHORAD capabilities in support of the maneuver force.

JOINT FUNCTIONAL COMPONENT COMMAND FOR INTEGRATED MISSILE DEFENSE (JFCC IMD)—LNTEGRATING AND SYNCHRONIZING MISSILE DEFENSE

JFCC IMD is one of the geographically dispersed elements for which I serve as commander. It is USSTRATCOM's missile defense integrating element, formed to execute Strategic Command's Unified Command Plan (UCP) assigned missile defense mission and enable the headquarters to focus on integration and advocacy. Headquartered at Schriever Air Force Base in Colorado Springs, Colorado, JFCC IMD is manned by a cohesive team of Army, Navy, Air Force, Marine Corps, government civilians, and contractor personnel.

> ***"This request supports additional efforts to detect, defeat, and defend against any North Korean use of ballistic missiles . . . "***
>
> —POTUS Fiscal Year 2018
> DOD Budget Amendment
> *November 2017*

As the Secretary of Defense and various Combatant Commanders have previously testified, warfighters remain confident in our ability to protect the Nation against missile attacks. However, as the global missile threat continues to evolve, we must invest in holistic approaches to defeat adversary missiles before launch or while in flight, as well as implement mitigations should an attack succeed in penetrating our defenses. JFCC IMD's principal mission is to coordinate with and operationally support the joint warfighters at the GCCs, and advocate for their requirements with the materiel developers at MDA and the Services. On behalf of the GCCs and USSTRATCOM, JFCC IMD champions warfighter priorities and capability needs, including continued development of a robust sensor network, integrated discrimination capabilities, resilient command and control networks with enhanced cybersecu-

rity defenses, and improved interceptors for both Homeland and regional missile defenses.

Through JFCC IMD, we work across DOD and alongside key allies and partners to improve integration of existing capabilities, maximizing efficiency and effectiveness in global missile defense missions. The essential force multiplier is integration-a critically important mission enabler that JFCC IMD directly supports. As a functional component command of USSTRATCOM, JFCC IMD executes support to designated UCP responsibilities along four lines of effort:

- Synchronizing global missile defense planning, global force management and missile defense security cooperation activities.
- Conducting global missile defense operations support, to include: asset management, alternate execution authority, federated intelligence support, and network monitoring and protection.
- Executing above element joint and combined global missile defense training, exercises, and experimentation.
- Advocating for and recommending acceptance of global missile defense capabilities, conducting analysis and assessments of current and future capabilities, and supporting ground & flight tests.

To accomplish these efforts, we maintain close collaborative relationships with the GCCs, MDA, the Services, OSD, the Joint Staff, and our allies and partners. We continually seek to enhance our deployed forces' capabilities while gaining operational experience and confidence in our collective ability to defend the Nation, deployed forces, partners, and allies. Some of our key efforts to enhance missile defense planning and capabilities for both the Homeland and regional architectures follow:

Expansion and Integration of the Missile Defense Architecture: In response to the evolving strategic environment, we continue to bolster Homeland and regional missile defense capabilities. In development of the global missile defense mission, we are supporting the advancement of the new capabilities such as Aegis Ashore in Poland; the Standard Missile 3 Block IIA under co-development with Japan; Long Range Discrimination Radar at Clear Air Force Station, Alaska; 20 additional GBIs in a new missile field at Fort Greely, Alaska; Homeland Defense Radar-Hawaii; Homeland Defense Radar-Pacific; Space-based Kill Assessment, and various other capabilities. Given the many challenges associated with implementation of these architectures, JFCC IMD, in support of USSTRATCOM's coordinating role for global missile defense, collaborates with the GCCs to assess and address cross-regional gaps in the areas of planning, policy, capabilities, and operations.

Multi-Regional Missile Defense Asset Management: JFCC IMD, in coordination with USSTRATCOM and the GCCs, manages the availability of missile defense assets to balance operational readiness posture, coordinates the scheduling of missile defense system maintenance activities, and supports MDA and Service test requirements. The asset management process allows us to continually assess our readiness to defend against missile attacks and to recommend adjustments to optimize the overall MD architecture.

Cybersecurity of the Ballistic Missile Defense System: JFCC IMD, in coordination with USSTRATCOM and MDA, conducts the Cybersecurity Service Provider (CSSP) mission for the BMDS to ensure cyber defenses and operations are planned and executed across the globe. JFCC IMD works with key stakeholders to enhance the cyber defense posture of our missile defense operational architecture against malicious activity. We are collaborating with our mission partners to incorporate realistic cybersecurity testing in support of the warfighter capability acceptance process. JFCC IMD also works closely with the Joint Staff, Combatant Commanders, and MDA to educate, train, and exercise cybersecurity protocols to ensure the highest levels of readiness.

Global Planning and Assessment: As regional and global missile threats continue to increase in number and complexity, JFCC IMD works with the missile defense community to refine processes designed to synchronize trans-regional, global missile defense planning and operations. Codified in periodic revisions to the Global Missile Defense Concept of Operations, these processes ensure unity of effort and mitigate potential seams and gaps across geographic areas of responsibility. Consistent with the Department's transition to planning based on adversary problem sets, we have continued to refine our process for adversary-centric plans assessment, and completed further objective analysis of missile defense risks across multiple GCC plans. This assessment methodology identifies systemic risk, informs recommendations for shortfall mitigation, and increases effectiveness in future missile defense planning efforts. The output of this analysis will inform our biennial Global Integrated Air and Missile Defense Assessment (GIAMDA) which shapes recommendations for global force management and future capability advocacy efforts. Looking forward,

we will focus our efforts with the warfighter community to establish approaches and processes necessary to enable increased integration and a more holistic approach to missile defense.

Plan and Conduct Synchronized Global Operations

Global Force Management: USSTRATCOM, as the designated Joint Functional Manager for missile defense, relies upon JFCC IMD to evaluate and recommend to the Joint Staff sourcing of missile defense requirements based on assessed risk. Due to the low density/high demand nature of missile defense assets, all sourcing decisions have a direct and significant impact on other Combatant Commanders' campaign and contingency plans. We continue to refine our approach to prioritize steady-state global missile defense requirements. This Global Prioritized Defended Asset List (Global PDAL) categorizes the GCCs' critical assets based on global risk. It informs our recommendations in the Global Force Management process, enabling senior leaders to make informed decisions on allocation of low density missile defense forces.

Allied and Partner Missile Defense Integration: Given that we will never have enough active defense capacity, integrating allies into a common and mutually supportive architecture is a critical warfighter priority. In support of those efforts, our Global Missile Defense CONOPS includes an International Engagement Framework which provides a common approach to identify potential partners, a model to identify a level of maturation, and an assessment mechanism. This approach formed the analytical basis for the Department's 2017 Report to Congress on Allied Integration. Another venue aimed at promoting increased cooperation is the Nimble Titan campaign, a biennial series of multinational missile defense experiments. Nimble Titan brings together policy and military subject matter experts from allies and partner nations to explore collaborative missile defense, synchronize policy and military initiatives, and identify potential future concepts. Today, ministries of foreign affairs and defense representatives from 24 nations, NATO, three additional multinational organizations, as well as DOD, OSD, Joint Staff, Combatant Commands, and MDA convene quarterly to exchange views and insights, experimenting collectively with policy and operational concepts. The Nimble Titan campaign provides a unique forum to advance U.S. missile defense policies and Combatant Commanders' regional security objectives. As the free world's premier strategic military and policy focused missile defense event, this campaign provides participating nations with critical opportunities for multinational and cross-regional discussions. The 28 member nations and international organizations work collectively to produce practical missile defense concepts and solutions to policy-military challenges; many of which influence and inform real-world missile defense policies and multinational planning.

"We must strengthen our collaboration with our allies and explore further integration of our collective capabilities toward an effective mutual defense."

—USSTRATCOM
HASC Posture Statement
March 2018

The Nimble Titan 2018 campaign culminated in the Capstone Conflict Event this March. In September, NATO will host a subsequent senior leader forum. This campaign addressed IAMD, deterrence and de-escalation, left-of-launch actions, passive defense, advanced technologies, interoperability, regional defense planning, alliance and coalition cohesion, and harmonized strategic messaging—challenges of concern to all participants. Nimble Titan has been a gateway for the U.S. to establish crucial relationships with allies and partners. It also informs the missile defense policies of the participating nations and international organizations. Events like Nimble Titan foster greater confidence in combined missile defenses and provide a means to advance U.S. efforts in collaboration, integration, interoperability, and burden sharing with our allies and partners.

Additionally, we have successfully integrated allies directly into the JFCC IMD staff through the Foreign Liaison Officer (FLO) program. Our first FLO, a German

Air Force officer, has been an integral player in Nimble Titan, NATO BMD Training, and allied and partner modeling and simulation efforts. We are seeking to add additional Foreign Liaison Officers to increase our understanding of allied missile defense policies, capabilities, and planning in order to optimize missile defense planning and force allocation.

Joint Missile Defense Training: In coordination with USSTRATCOM, the Joint Staff, Combatant Commands, and the Services, we continue to develop comprehensive and innovative training programs to close gaps between Service, joint, and regional missile defense training and education. JFCC IMD's Joint Ballistic Missile Defense Training and Education Center, or JBTEC, expanded its curriculum to meet warfighter demands. It now offers 15 mission-oriented resident and Mobile Training Team (MTT) courses, and online courses to include orientation, staff basic, and asset management training. Over the past year, JFCC IMD instructors executed 233 courses, training over 4,200 students worldwide. Additionally, in keeping with Joint Vision 2020, JFCC IMD provided training courses to our allies and partners through military-to-military and Foreign Military Sales training venues.

Warfighter Capability Acceptance and Integrated Master Test Plan: As missile defense architectures mature, warfighters require a credible, comprehensive assessment of new capabilities to inform operational acceptance into the global BMDS. The warfighter relies on a robust and operationally relevant test campaign to confidently field and integrate new capabilities into their existing IAMD architectures. As noted previously, warfighters supported the May 2017 FTG–15 GBI test which demonstrated the first ever Exo-atmospheric Kill Vehicle (EKV) intercept of an ICBM-class target. Also in 2017, JFCC IMD supported a successful intercept flight test of the United States and Japanese co-developed SM–3 Block IIA interceptor for Phase III of the European Phased Adaptive Approach (EPAA) architecture. In fiscal year 2019, the Department has an Aegis BMD and Aegis Ashore intercept test planned that will demonstrate the multiple simultaneous engagement of two IRBMs using the same EPAA Phase III architecture. The Navy and MDA will demonstrate fleet defense using a salvo of two SM–6 missiles. Additionally this year, we plan to demonstrate coordinated THAAD and Patriot interceptors in a simulated engagement using a live target.

In summary, JFCC IMD continues to expand our Nation's global missile defense architecture and explores future capabilities to maintain operational advantage against current and future threats. Competitive edge is maintained through integrated planning and operational support, deliberate investments in our capability developments by MDA and the Services, investments in our warfighters through education and training, and expansion of collaboration with our allies and partners.

CONCLUSION

Madam Chairman Fischer and Ranking Member Donnelly, as a member of the joint missile defense community, the Army continues to pursue enhancements to the Nation's IAMD systems, from the tactical to the strategic levels of warfare. As outlined here, USASMDC/ARSTRAT and JFCC IMD perform a broad set of critical national security missions. These missions include providing professional warfighters and capabilities to support current operations, ensuring they are prepared for tomorrow's fight, and developing new technologies required to maintain a technological advantage against the adversary threat. Our trained and ready soldiers, operating GMD elements in Colorado, Alaska, New York, California, and from remote, globally deployed locations, remain on point to defend the Homeland against an ICBM attack. As a force provider to the GCCs, our soldiers provide essential regional sensor capabilities, ballistic missile early warning, and satellite communications. Our regional forces continue to leverage allied collaboration and planning efforts in developing integrated and interoperable defenses against the various threat sets. USSTRATCOM, through the JFCC IMD, continues to integrate BMDS capabilities to counter global missile threats and to protect our Nation, deployed forces, allies, and partners.

While operational, doctrinal, and materiel developments are essential, our most important assets are the thousands of soldiers, sailors, airmen, marines, civilians, and contractors who deploy and operate our IAMD systems. As recognized by Department leadership, the strength behind our outstanding workforce is their families. Their contributions and sacrifices are foundational to the dedication and performance of our workforce—the role and support of our families empowers mission accomplishment.

I appreciate having the opportunity to address missile defense matters and look forward to addressing your questions.

Senator FISCHER. Thank you all very much.

We'll begin our first round of questions.

General Robinson and General Greaves, you both have talked about the defense capabilities that we have currently with the most pressing threat that we have, and that's North Korea. But in your opinion, does this budget keep us on a path to stay ahead of the threat that's posed by North Korea?

General ROBINSON. So, ma'am, I'll talk first, and then I'll let General Greaves, since he is the smart one.

Here's what I worry about. As I paid attention, we appreciate the ATR [Automatic Target Recognition] that was given to us last fall. It allows us to build capacity.

You and I chatted a couple of times. The fact is when we looked at what KJU [Kim Jong-un] was doing last May versus what happened through the summertime, this capacity and this Redesigned Kill Vehicle will be very good for us in Alaska. But at the same time, we're not taking our eye off of having a better discriminating radar.

I would tell you that where we are and what we're doing right now keeps us ahead of what's happening. We just can't take our eye off the ball.

And I'll turn it over to General Greaves.

Lieutenant General GREAVES. Chairman Fischer, the answer is yes. As I mentioned, the current ballistic missile defense system can meet today's threat, and both the fiscal year 2017 ATR, the fiscal year 2018 budget amendment, and this budget, what it does is increase our capability or our capacity, more rounds in the ground, whether it's ground-based interceptors or THAADs or Aegis 3 IBs, or ultimately the IIAs. So I believe we are perfectly positioned to defend against today's threat.

The other thing the budget does, it helps us keep our eye on the advancing threat as North Korea in particular and Iran, as they both increase their capability, both in numbers and lethality. We must ensure that we look ahead at what capability will be required to stay apace of that threat.

In the area of space sensors or deploying the terrestrial architecture to space to supplement and augment what is on the ground, keeping track of that capability is quite essential.

Thank you.

Senator FISCHER. And United States Force Korea, you've submitted that request. Can you talk a little bit about the request and the importance of receiving funding this year? You outlined it a little bit, but what is the priority for it this year?

Lieutenant General GREAVES. It's a very high priority. In fact, it was sensitized to me during my last visit to Korea with General Brooks. We spent over an hour about two to three feet away, and he impressed upon me the importance of what's in that GEON. What it does, a couple of things. One, it allows us to disconnect the fiber tie between the THAAD control center and its launchers to increase the battle space by moving the launchers out. It allows the Patriot capability to essentially use the power of the THAAD radar to expand its battle space. And then it does what I believe is extremely important, integrates THAAD and Patriot to essentially optimize use of the interceptor so you minimize or eliminate wastage. So for General Brooks being right there on the front line, that

was extremely important to him to ensure that we expand the battle space and optimize use of those precious assets.

Senator FISCHER. Usually items on the UFR [Unfunded Requirements] list are there because they were judged to be of lower priority than the items that are included in the basic budget request. As I understand it, however, this funding appears on the UFR list as a result of timing. Is that correct?

Lieutenant General GREAVES. That's correct. The items you see on the——

Senator FISCHER. It's not a reflection of the priority, then, in this case?

Lieutenant General GREAVES. Not in my mind.

Senator FISCHER. It was all due to timing.

Lieutenant General GREAVES. Yes, ma'am.

Senator FISCHER. Okay. And, Secretary Rood, when do you expect to complete the MDR [Missile Defense Review]?

Secretary ROOD. We're in the process of doing that work now as we speak, Senator, and we're looking in the near term here, in the spring, to finish that review. There are a number that you highlighted in your statement, some of the challenges in the threat environment that we face, so we're eager to stay ahead of that threat, and we're looking at some competing approaches to do that. But I expect we'll have that shortly to you.

Senator FISCHER. General Hyten noted some difficult policy questions in there, and we heard that boost phase term on an opening statement, that that's a big challenge. Is the Department formulating policies to fill that gap so that you can address those challenges that are associated with the boost phase intercept as part of the MDR?

Secretary ROOD. Yes. We're looking at boost phase defense. As mentioned, this is a period during the missile's flight when it is vulnerable to attack. It's a challenging period to be able to execute an effective missile defense during that period due to the geographic constraints and other things, but we are looking at a variety of ways to try to accomplish that goal.

Senator FISCHER. Including lasers?

Secretary ROOD. Yes.

Senator FISCHER. Thank you.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

I want to thank all of the witnesses again for being here.

Undersecretary Rood, can you tell me how and why the review changed from the ballistic missile defense review to the missile defense review?

Secretary ROOD. In terms of the rationale, Senator, the ballistic missile defense review was looking, of course, at ballistic missile defense, defense of missiles that fly over a ballistic trajectory. The thought process was that there are other forms of missile attack, cruise missile attack, hypersonic glide vehicles and the like that were of a similar nature, and their challenge in the integrated air and missile defense systems that the Services are pursuing to provide defense for our troops in the field, our allies and things of that nature, that it was important to see a connection there, and that was the rationale. Of course, it predated my arrival at the Depart-

ment to do that, but I support that decision because of the integrated security challenge that we face with those threats.

Senator DONNELLY. General Greaves, can you tell us how you contributed input into the missile defense review?

Lieutenant General GREAVES. Yes, sir. We have key members of our staff from the engineering directorate, from our command and control battle management directorate, from other parts of the organization that have met frequently with other members within the Department to help construct the MDR. So we've been actively involved.

Senator DONNELLY. General Robinson, can you please tell us how you helped contribute input into the missile defense review process?

General ROBINSON. Absolutely. I think what's important as the warfighter and the one defending the United States, I've been able to contribute saying that I need to be able to detect, identify, track, and when necessary engage to defend the United States. So whether it's ballistic missiles, whether it's cruise missiles, I've been able to give as the battle space owner my opinion and support my brothers here at the table.

Senator DONNELLY. General Dickinson, same question.

Lieutenant General DICKINSON. Yes. We've contributed in a large part to the effort in terms of JFCCIMD or the role that I play as the integrated missile defense element for U.S. Strategic Command. So we've been participating throughout the process, and what we bring to the process is we bring the representation of all the combatant commands along with NORTHCOM in terms of providing that expertise and that perspective as we help to develop and shape the document.

Senator DONNELLY. General Greaves, I understand you're trying to accelerate the development and fielding of the Redesigned Kill Vehicle to address the growing threat, and what I would like to know is can you describe for us the ways you're mitigating the risk in the program and ensuring we have a capability that is fully tested before it is deployed?

Lieutenant General GREAVES. Yes, sir. This development will be a gated, milestone-driven acquisition in specific decision points along the way where the Department, not only the Missile Defense Agency, will assess readiness to proceed to the next phase. As an example, we completed the preliminary design review last May and used that as a decision point to convince anyone from the CAPE [Cost Assessment and Program Evaluation], the then AT&L [Under Secretary of Defense for Acquisition, Technology, and Logistics], Ms. Lord, and others within the building that we were ready to proceed with obligating, I think it was, $56 million worth of advanced procurement.

So what we have done is we have taken great care and we have heeded the NDAA [National Defense Authorization Act] language that addresses fly before you buy, with the specific wording that talks about assessing our readiness to make these decisions through either adequately assessing through tests or some other method before we make these production and deployment decisions. So we will make decisions after, as I mentioned, the preliminary design review. We have the critical design review coming up in De-

cember where another subset of that funding will be assessed, and we've got a decision to make after the first control test vehicle test, which will now include not only a fly-out of the interceptor but a target where we will maneuver to the target but then maneuver away after convincing ourselves that we would have engaged the target, and we will use that extra capability to assess how well the interceptor does in the combined or expanded battle space.

So the bottom line story, sir, is a gated, milestone-driven, thoroughly reviewed assessment along the way.

Senator DONNELLY. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator.

Senator Cotton?

Senator COTTON. Thank you all for appearing today for your testimony.

General Greaves, let's talk a little bit more about boost phase intercept. I will reveal that I am a major proponent of this technology at the outset. The boost phase missiles are big and they're hot, so easy to detect, and most importantly they're over the bad guys' territory, not over ours. But they don't come from just anywhere on earth. There's a limited number of countries on earth that have this capability, and they intend to challenge us, and that boost phase intercept is at risk. Two obvious candidates are Russia and China. But is it fair to say that boost phase defenses are not really suitable against that threat because those countries are so large and they can position their missiles so far inland?

Lieutenant General GREAVES. I would say so, yes. There is a geographical component of it. Boost phase intercept is, if not ideally, well-suited to, say, the Korean Peninsula where, as you say, they can't go far back.

Senator COTTON. Those are the magic words. So since Russia and China are not really susceptible to effective boost phase missile defense, where is it? North Korea. Maybe Iran as well, but North Korea is where it's really suitable.

We talked about the lasers earlier. I want to come back to those in a bit.

What is the agency doing to explore the feasibility of airborne hit to kill defenses, specifically on UAVs [Unmanned Aerial Vehicles]? What kind of technology gap do we have today, given what we're already capable of doing with a UAV, in air-to-ground attack that might help neutralize or at least mitigate the North Korea threat?

Lieutenant General GREAVES. We are doing technology development. That is a phase of acquisition that we're in, looking at both directed energy components as well as most likely taking advantage of air assets which will already be in the theaters in support of other mission sets, executing by the COCOM [Combatant Command] to look at those assets, either sensors that could be fed into the command and control battle management system within our ballistic missile defense system, or at shooters. They could be platforms for a new breed of fast interceptor weapons that if placed appropriately or closely or in the right position would be effective boost phase intercept capability.

Senator COTTON. I'm a big fan of manned aircraft as well, but manned aircraft have men and women in them, so they have limi-

tations, right? They have to land, they have to eat, they have to sleep, so on and so forth. UAVs do not. How high a priority is it for the agency to explore the possibility that we could put an effective airborne net over the Korean Peninsula with UAVs, both sensor platforms and armed platforms in international waters, that could potentially prevent North Korean missiles from ever getting off of the launching pad?

Lieutenant General GREAVES. It is a high priority within the Missile Defense Agency, and the phase that we're in now is the technology piece of it. For instance, directed energy. Can we get——

Senator COTTON. Can we get to directed energy for a moment? So given what we can do with a UAV and air-to-ground attack right now, what is the gap of taking that kind of demonstrated and deployed technology and deploying it in that kind of system against North Korea? And rather than aiming it at a terrorist's home or car, aiming it at a North Korea missile on the launch pad?

Lieutenant General GREAVES. The full answer will have to be coordinated with the combatant commander. But the gap or limitation is numbers and altitude and duration for the platforms of interest, and we have been doing some preliminary work on that over the past few years. And again, we're not talking directed energy, but doing things such as beam pointing, stability, duration, and pseudo con ops development on it. But the actual placement above, around, in the vicinity of the targets, that's a COCOM decision.

Senator COTTON. Okay. I just think it's an extremely high priority, and most people probably underestimate how close we are to that kind of solution. I know that's not the long-term solution. That's why I want to put directed energy or lasers to the end of the conversation. I know that's a little bit longer, but that's ultimately the right solution, I think. Once lasers get shrunken down so the power source can actually fit on an aircraft like that, then I strongly support that as well. But I think that we have a real opportunity in the very short term, not a matter of months but not a matter of decades either, to if not neutralize the North Korean threat with airborne boost phase systems, at least severely mitigate it.

Thank you.

Senator FISCHER. Thank you, Senator.

Senator Sullivan?

Senator SULLIVAN. Thank you, Madam Chair.

Just to follow up on Senator Cotton's questioning, General Greaves, is the technology available right now to do that?

Lieutenant General GREAVES. Sir, I'd say portions of the technology are available. For instance, the current suite of kinetic weapons that we have that could potentially fulfill that role, they may not have the distance, the legs as we call it, to execute even if we had the UAV technology flying and ready to go. The concept of operations is extremely important with respect to how many caps are flying, where those caps are located, the resources tail that goes behind it. But those are not my areas of responsibility. That's the COCOM. But the technology is getting closer.

Senator SULLIVAN. Okay. Good. That's good to know.

General Robinson, thank you. I missed your opening statement, but I understand you had an announcement, which we're kind of shocked and, wow, you've been an historic figure. I want to thank you for your service, the first female combatant commander in the history of the United States. Thanks for coming up to Alaska so much, we appreciate that. Recently at the event that we both were at, it was a great evening, so thank you. Thank you for your wonderful service.

I wanted to talk a little bit, I mentioned to a number of you, General Greaves as well—so we made good progress in the last year, I think, with regard to a missile defense bill from this committee, passes in the NDAA, fully funded in December. I was out on a CODE [Congressional Delegation] led by the current chairman, acting chairman of the Armed Services, Senator Inhofe. We were in Alaska. We went out to Fort Greeley. Part of the funding and the new authorization is for a new field out there, a lot of excitement. We're on the ground looking at it. And then we hear 5 to 6 years, 5 to 6 years, before we get this field operational.

Now, we won World War II in a shorter amount of time. I can go through a whole list, and the Chair is very focused on these issues, not just in the military but building roads, whatever.

Why on earth should this take 5 to 6 years? What do you need—I've already talked to a number of you—legislatively, because I'm sure it would be bipartisan, to say, hey, the threat is here, the threat is here right now, we need more capacity. A new field at Fort Greeley is more capacity.

What can we do to help you make this so it's not 5 to 6 years, a half a decade, to get a new field operational? We should try to get that done in a year and a half, in a year.

So, General Greaves, I know I just pitched this to you the other day, but we want to get this in the NDAA to help you, to help America defend itself when there's enormous bipartisan support to do it. Five to six years, to me, is lunacy. What can we do?

I'll throw this out to any of the witnesses.

Lieutenant General GREAVES. Sir, if I can start, one update to our conversation yesterday, the environmental impact statement for Fort Greeley was done for the 100 interceptor base when the field was first developed.

Senator SULLIVAN. Right, right.

Lieutenant General GREAVES. So what we have to do for the additional 20 is an environmental assessment, and that work is just about done.

Senator SULLIVAN. Okay. Good.

Lieutenant General GREAVES. So that's off the table.

The construction of the missile field itself is an approximately 36-month effort, and the limitations involved in——

Senator SULLIVAN. They built the Alcan Highway in 11 months.

Lieutenant General GREAVES. Yes, sir.

Senator SULLIVAN. I mean, there's a long list of things in America we used to build quickly. Even 3 years is pretty darn long, right?

Lieutenant General GREAVES. Yes, sir. Those 3 years are paced by the standard building timeframe up in Alaska, April through October. Now, there are things that could be done——

Senator SULLIVAN. We build year-round in Alaska on occasion.

Lieutenant General GREAVES. Yes, sir. I was about to say there are things that can be done to essentially reduce that time, but the pacing item for the additional 20 GBIs in the ground are the GBIs themselves and the fact that they were being procured as all-up rounds with the Redesigned Kill Vehicle on top. And the approach, unlike what was done for the initial deployment of the initial interceptors, where we essentially have done exactly what you're asking, we are taking a series of steps to ensure that what we are designing, building, testing, and delivering are more reliable, more maintainable, and for the long term more sustainable. And the acquisition of that under the current set of guidelines—we talked about that a little earlier—is a gated and milestone-driven decision process.

There are a number of folks, other entities within the Department that are involved, all the way from the operational testers to the folks in CAPE to the folks in now A&S, acquisition and sustainment, that have to be involved to ensure that we are minimizing risk for this deployment. Now, if it was stated that there is some national security waiver to get them into the ground now and to provide the Missile Defense Agency and others with complete authority to do things, then we could, of course, move out faster at a higher level of risk.

But we learned some significant lessons from the deployment of the initial set of GBIs where we had to go back and complete the systems engineering for those rounds, and it's taken us quite a bit of time to do it, and we have now completed that.

The intent here is, keeping the threat in mind, we already accelerated the planned deployment of those GBIs by at least a year, to 2023, beginning in 2021, going out to 2023. But to accelerate it further brings increased risk. We feel very confident we can deliver it per the timeline that we got.

Senator SULLIVAN. Well, we want to work with you, all of you, on accelerating that.

Senator FISCHER. Thank you, Senator Sullivan.

Secretary Rood, if I could continue with another issue on the missile defense enterprise, we know it struggled with the increasing portion of the MDA's [Missile Defense Agency's] budget that's going to procurement and taking money away from what really is the MDA's chief purpose, and that's research and development, and while we all support the significant increase in MDA's top line that's included in this year's budget, I think it actually exacerbates this issue. MDA's budget grew by almost $2 billion compared to the projections in last year's budget, and about 45 percent of that increase went to procurement.

Do you expect the MDR to look into this issue?

Secretary ROOD. One of the things that is a challenge facing us in the Department is the Missile Defense Agency's role, as you said, as a research, development, testing, and evaluation organization. They've also played a substantial role in operations and sustainment of systems once we have them in the field. And one of the organizational issues that we need to work through is the transition, at what point and how do we transition those capabilities to the services to manage. That's been something the Depart-

ment has struggled with for quite some time. For the past decade and a half, that's been a discussion item.

So that is one of the things in the missile defense review that we are looking at because we want to make sure that we get the balance correct, where MDA's work on near-term production—that is to say, current systems—and the balance about new system development, advanced capabilities. There's always a balance about how much do you invest today and how much in future technology, and getting that balance correct is one of the things we're looking at.

Senator FISCHER. I hope you are able to do that.

Secretary, for all of Russia's talk about how the United States missile defenses jeopardize strategic stability and justifies their violation of arms control treaties or pursuit of new nuclear weapons—President Putin's speech was the latest example of that—isn't it true that Moscow deploys a highly capable ballistic missile defense system?

Secretary ROOD. They do. The Russians have maintained and indeed, at times when their budgets were most stressed, they continued to modernize the Moscow anti-ballistic missile defense system. I can say from the time when I previously served in government, in the 2001 to 2008 period, having routine discussions with the Russians about that, and they're very blunt about the fact that that's a high priority for them, to defend their capital and their people, where the majority of their population lives, against ballistic missile attack. Their basic argument is that they don't wish the United States to do that.

I don't accept that argument, and I would note that it's a new argument from President Putin. In 2001, when the United States announced its withdrawal from the ABM [Anti-Ballistic Missile] Treaty, President Putin gave a national address in which he stated this posed no threat to Russia's national security, and shortly thereafter he agreed to the conclusion of the Moscow Treaty, which at that time and to date is the largest reduction in strategic nuclear forces that our two countries have done.

So I read very carefully his recent statement, and we weren't surprised by what was announced, certainly disappointed by the tone in that statement, but it's a new discussion item, it's a new characterization I think of what has led to those capabilities that we're seeing from President Putin.

Senator FISCHER. Do you have any thoughts that you can share with us on why you think President Putin is making this new case?

Secretary ROOD. I think it is twofold. One, the context of that speech. The vast majority of it dealt with domestic issues. It was a bit of a—State of the Union speech wouldn't be exactly the right description of it, but it covered a whole range of topics, mostly focused on domestic issues. The tail end did focus on defense capabilities and those particular capabilities.

Senator FISCHER. Was it a political speech do you believe, then?

Secretary ROOD. Yes, but it was more than that. It certainly was messaging to the rest of the world and the United States. So we should see it for both. And it was noteworthy that President Putin showed an animation of a missile strike on the United States. There is only one other country that has done that, North Korea.

It was also noteworthy that it was not the only time or effort where the Russians have signaled things to us in the United States.

So I think while it was a political speech, it was also a message to the United States and the rest of the world about how they see us and that security environment and the capabilities that Russia is pursuing.

Senator FISCHER. Thank you, Mr. Secretary.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

General Dickinson, DOTE [Director of Operational Test and Evaluation] continues to find the Army's training of its soldiers to conduct testing of THAAD and Patriot is insufficient. In the fiscal year 2017 report, DOTE found that flight testing in fiscal year 2017 demonstrated that THAAD training and documentation deficiencies worsened in fiscal year 2017, and Patriot training remained inadequate to prepare operators for complex Patriot engagements.

In your role as Commander of Army Space and Missile Defense Command, you have the responsibility to organize, train, and equip Army space and global ballistic missile defense forces. Do these insufficiencies concern you, and what are we doing to improve the training?

Lieutenant General DICKINSON. So, the air and missile defenders in the Army in particular that I can speak for go through a very rigorous training program from the time that they come in to their initial assignments into their units. They go through a very detailed and comprehensive training strategy that's codified and developed into what we call table training, very similar to what you may see in an armor unit that has tables 1 through 12 that are very prescriptive and descriptive in highlighting the tasks that need to be completed as they move along from an individual type of qualification as an individual solider operator into a team or into a crew.

That spans from a Patriot unit to a THAAD unit, even to a GM [Ground-Based Missile] unit, and I'm responsible for providing trained and ready forces to General Robinson in the GMD world in terms of the 100th and the 49th missile defense units. But I can assure you that that training development and that training proficiency is measured on a very frequent basis and is tested frequently on the actual equipment, and we also use a host of simulations in order to develop that.

Senator DONNELLY. So, then, is the fiscal year 2017 DOT&E report wrong in its conclusions?

Lieutenant General DICKINSON. I wouldn't say it was wrong. I would have to look closely at the scenarios in which they were evaluating those. I will tell you from my experience as a commander on the ground and through the evaluations that I run that the training proficiencies, particularly with the GM system, are at a very high state, and I don't believe DOT&E was evaluating the GM soldiers. I know they were on the THAAD and Patriot.

General ROBINSON. Senator, if you don't mind, I had the privilege to go to Fort Greeley and watch the soldiers, so I know from the time that I have to give some authorities that I have to the execution that happens on the ground at Fort Greeley for me to be able

to sit down and talk to the soldiers that do this each and every day from a training perspective, I was very proud to watch them, and I know that this training goes on more than once a day, every crew, both from my command center in Colorado Springs down to the soldiers at Fort Greeley. So I just wanted to add that as a warfighter.

Senator DONNELLY. General, I have great respect for them, too, and appreciate everything they do for our country. So how does the report come up with that conclusion?

General ROBINSON. I'd have to go back and do like General Dickinson said and go see what was the scenario that they looked at, to give it a little more context, because of what I watched and observed myself. So I owe you my best military advice if I go back and re-read what was given.

Secretary ROOD. If I might add also, I'd have to go back, as I mentioned earlier, take a look at the report and see what the scenario is. If it was a test scenario, for example, sometimes they will look at that during one of MDA's tests, operational tests, or whether or not they were in the field with the soldiers at that time. So the circumstances are very important here.

But I can attest to the fact that at every level within their training program, they are trained and certified. It's a series of written evaluations, a series of hands-on evaluations, and then performance-oriented evaluations conducted by, many times, outside agencies. What I mean by that is outside their immediate chain of command. And there are passes, and there are failures, and we do that routinely both in the United States as well as to our deployed forces overseas.

Senator DONNELLY. Okay. Well, I am about out of time. General Robinson, thank you again. As you head toward retirement and travel around, when you go to the Air Force Academy Notre Dame football game, I am curious as to who you'll be rooting for.

General ROBINSON. Well, when your husband is an Academy graduate and your brothers are Academy graduates, there's really not much that I can say. So, go Air Force.

[Laughter.]

Senator DONNELLY. Thank you.

Senator FISCHER. Thank you.

Senator Sullivan?

Senator SULLIVAN. Thank you, Madam Chair.

Mr. Secretary, good to see you again, and I'm glad you're in this position. You have a background with a lot of expertise in these areas.

Let me ask on the missile defense review, when are you anticipating that being done? And the reason I ask is one of the things that we'll be looking at with regard to the NDAA this year is building on what we did last year with regard to missile defense. We had kind of a breakthrough, I think, politically. We had a bill that was included as part of the NDAA which was a pretty significant advancement in missile defense that was very bipartisan. If you look at the history, missile defense has not always been bipartisan. As a matter of fact, it's kind of been a partisan issue. But in this case, I think we made a breakthrough.

I'm asking this because we will be looking at kind of a missile defense 2.0 component of the NDAA, but we want it to be significantly informed by the work that the Pentagon is doing. So when do you anticipate that being done, and is there a timeline we can hold you to that would be in front of the work that we're doing on the NDAA, which you know is kind of already starting?

Secretary ROOD. We're at work now on the missile defense review. There are a number of real challenges that we're still working through how specifically we will address in that report. But I am pleased that we've come a long way. So I think this spring we firmly plan to complete the report. Right now we still have some internal discussions in the Department to work through, different opinions, as you'd expect, on certain questions. But I think we'll have something soon, and I understand your point about wanting to take that into account, and the legislation that you sponsored last year was very noteworthy in advancing the ball down the field on missile defense, and the NDAA markup schedule is certainly something that we would want to take into account.

Senator SULLIVAN. Great. Do you think sometime in April? I mean, I'm going to try to hold you to something here, Mr. Secretary.

Secretary ROOD. I wouldn't want to commit to——

Senator SULLIVAN. I'm putting your feet to the fire.

Secretary ROOD. I feel the heat already rising around me.

Senator SULLIVAN. Good, good.

[Laughter.]

Secretary ROOD. I wouldn't want to commit to April to get it to the committee, but certainly we'll be deeper into our discussions by that time. But I think in the next couple of months here, that is our intention to finish it.

Senator SULLIVAN. Okay, because we don't want to miss—I know there's a lot of work, a lot of expertise going into this, but we want to keep in mind the vehicle that will move legislatively to enact some of these ideas and reforms you have in the review is going to be the NDAA. We're going to be marking it up late April, early June, so I think it's important to keep that in mind.

One element that we started on in last year's legislation but as I talk to the experts, essentially everybody at the table and General Hyten, there seems to be, I would say, broad-based consensus on what we need to do more with regard to the next steps is space-based sensors that are integrating both kind of theater and Homeland missile defense. Would that be something that all of you are in agreement on, the need to accelerate and really focus on that unblinking eye being able to track? Can I get an answer from each of you, if that's something you think is worthy of us to be working with you on to pursue as a program on our missile defense systems?

Lieutenant General GREAVES. Senator Sullivan, absolutely. That is where we need to start.

Senator SULLIVAN. General Robinson, would you agree with that?

General ROBINSON. I do, but let's not forget what we need to make sure is that we can do what we need to do today as we look to the future.

Senator SULLIVAN. I agree. Great point.

General ROBINSON. Okay. That's the only thing that I would add to the conversation.

Senator SULLIVAN. Thank you.

Mr. Secretary?

Secretary ROOD. Support in this year's budget, we're going to talk about doing some demonstrations on space-based sensor capability, as you know, and I think continuing to build on that is one of the things that we would like to do. We've got to look at that in the context of the other budget challenges as we put together the next 5-year budget submission through the remainder of the year. But I certainly am supportive of continuing to explore that.

Senator SULLIVAN. Okay.

General Dickinson?

Lieutenant General DICKINSON. Absolutely. I think the better you see the potential threat, the better we'll be in the redundancy and resiliency of having terrestrial-based sensors as well as space-based sensors that provide us that capability, especially as we look to an increasing, evolving threat. So the better information we have, the better opportunity and the better ability we'll have to defeat it.

Senator SULLIVAN. Madam Chair, do I have time for one more question?

Senator FISCHER. Okay.

Lieutenant General GREAVES. If I could add, just really quickly, the integration of sensors in space with the terrestrial sensors are absolutely critical for the real threat that we see in front of us, the hypersonic threat, earth to burst tracking, and that's why I said absolutely.

Senator SULLIVAN. Okay, great. Thank you.

Let me ask one final question that goes to the issue of testing. Again, what we tried to do in the legislation last year was really kind of give cover to all of you, not in terms of "failures" but to start to make the point not only to Congress but the American people that when you are testing, even if you're not hitting a target or a successful flight, you're learning, you're learning. Our space program, you only have to look at that in the 1950s and 1960s. We were "failing" all the time. But we weren't failing. We were learning.

Kim Jong-un, I would never want to use him as an example, so I'm not, but the guy is obviously testing, failing, and learning. So we are trying to provide you with a sense from the Congress that, hey, the next time you do a big test, if it doesn't hit the target, it certainly would be my intention not to drag all of you up in front of this committee and pound the table and look for the TV [television] cameras and try to berate the people with stars on their shoulders that you're failing, because you're not failing, you're learning.

So, we started that in last year's NDAA. We're trying to accelerate and put you on a schedule to do tests at least yearly. But what more can we do to help you in terms of your testing, even if you're not always hitting the target? My understanding in talking to some of the experts, there will be certain tests that we're stretching the envelope, from physics, from the activities that we're

doing, so much that you almost think that you're going to miss the target anyway, and you're still going to learn a ton.

What more can we be doing to help you in the Congress so your culture of testing is not so worried about some of us calling you up here the next time there's a missed target when we're still learning tons?

Lieutenant General GREAVES. Senator, I'd say what you've just stated is sufficient, in my mind, in that we're not only learning when we don't achieve an intercept, we're also delivering capability.

One example I'll use is the recent SM–3 IIA mission that we just executed. We did not achieve an intercept. We believe we understand why we did not. But taking a look at what we did achieve, we achieved the demonstration of launching the SM–3 IIA from Aegis ashore, which is absolutely critical for the sites in Romania, in Poland, and if the Japanese continue with their acquisition of the two Aegis source sites. It's a clear demonstration of that capability.

We also increased the battle space for that weapon system. We flew outside the organic radar's capability and demonstrated feeding off-site sensor information, engagement-quality information to that interceptor as it was in flight.

We also certified the Aegis weapon system baseline that accompanied all that capability.

So we did not achieve that intercept, but we learned and we delivered capability. What you have stated, sir, is sufficient in my mind because it lends a level of understanding that we do a lot more than just intercepts.

Senator SULLIVAN. Yes. Anyone else want to comment on that? One thing I've thought is you guys could do a background briefing to our wonderful friends in the media who love to look for "failures." They don't really understand the issues. And if you can background the media on this, that it's not a failure, it's a learning opportunity.

But anything else, Mr. Secretary? General?

Secretary ROOD. I certainly concur with the approach. Throughout our history, the things where we've had some issues—first of all, we generally have issues at some level in virtually every new cutting-edge endeavor. So I wholly concur with the thought process that you're taking. And it's not just us. I think in some ways when we look at our allies like Israel and their test regimen, they're much more willing to go back out to the test range, begin a flight test regimen, work through their issues, understanding there are going to be bumps in the road.

So I certainly second the approach that you're trying to encourage us to take.

Senator SULLIVAN. As you probably know, Mr. Secretary, the Israelis are actually testing right now in the great state of Alaska, in Kodiak, Alaska, so they're learning a lot there as well.

Lieutenant General DICKINSON. Senator, if I could, just one final comment on that.

Senator SULLIVAN. Yes, sir.

Lieutenant General DICKINSON. As General Greaves described in terms of learning a lot, first of all I think your approach is right on. I think that's what we need.

But the other piece that goes in, not only on the learning piece to the technology under development, but there is a big learning piece between the warfighter as well as the material developer, in this case MDA. So that's actually a relationship that we enjoy on a daily basis between the 100th and the 49th and the Missile Defense Agency. That ability to have the warfighter working side by side with the material developer in a test scenario, for example—and I'll use the FTG–15 a year ago, where we actually had a crew out of the 100th that actually executed the warfighting piece of that test, launching the interceptor for that engagement—is the fact that we learn a lot from the warfighter's perspective.

Then we also are able to inform the material developer on the road ahead, are they developing the things that the soldiers can use. So I would just offer that.

Senator FISCHER. My thanks to the panel today for your testimony and your willingness to give us some pretty blunt answers. We appreciate that, and I thank you all for your service.

And thank you again, General Robinson, for your service to this Nation, and we wish you all the best.

General ROBINSON. Thank you, ma'am.

Senator FISCHER. Thank you.

The hearing is adjourned.

[Whereupon, at 3:43 p.m., the subcommittee adjourned.]

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR DEB FISCHER

RADAR ACQUISITION STRATEGY

1. Senator FISCHER. Lieutenant General Greaves, do you intend to hold separate full and open competitive procurements for the Homeland Defense Radar—Hawaii (HDR–H) and Homeland Defense Radar—Pacific (HDR–P) to ensure the most competitive price and latest technology in each?

Lieutenant General GREAVES. Missile Defense Agency (MDA) acquisition strategy includes the use of a full and open competitive multi-award indefinite delivery, indefinite quantity (MA IDIQ) fixed price incentive firm (FPIF) contract to support the competitive procurements for both the HDR–H and HDR–P. MDA plans to award the MA IDIQ contract to multiple contractors in October 2018. The HDR–H contract will be awarded in December 2018 as delivery order Number 1 on the MA IDIQ contract. The HDR–P will be competitively awarded as a follow on delivery order in 4QFY2019 timeframe. The MA IDIQ contract will include the option for a potential third Homeland Defense Radar delivery order. This approach enables MDA to maintain competition to ensure the best price, while also ensuring access to cutting-edge technology for each of the three potential future radar delivery orders.

JUNIPER COBRA

2. Senator FISCHER. Lieutenant General Dickinson, the United States and Israel recently concluded ballistic missile defense drills as part of the Juniper Cobra exercise. How do you asses the results of the Juniper Cobra exercise and what were some of the highlights related to missile defense activities?

Lieutenant General DICKINSON. Juniper Cobra 18 provided an unmatched opportunity to exercise our bi-lateral relationship with Israeli Defense Forces in a realistic and challenging exercise construct while conducting missile defense operations at the operational and tactical levels. Working collaterally, United States and Israeli soldiers, sailors, airmen, and marines practiced and refined tactics, techniques, and procedures critical to the successful execution of designated operation plans. Tactical U.S. missile defense units validated eleven battle positions and related command

and control links, executed Joint and Combined United States and Israeli battle staff operations, and fought complex and layered simulated air battles with multiple missile defense systems. Key outcomes included validated confidence in the ability of United States and Israeli missile defense forces to successfully conduct Joint and Combined operations, a strengthened relationship among United States and Israeli forces, and a successful exercise demonstration that included both Patriot and Iron Dome.

IFPC

3. Senator FISCHER. Lieutenant General Dickinson, considering the Army's current plans for Indirect Fire Protection Capability (IFPC) envision reaching initial operational capability (IOC) until the end of 2023, is the Army evaluating any alternative systems, such as the Iron Dome system or NASAMS, that could provide near-term capabilities against cruise missile threats, or rocket, artillery, and mortar (RAM) threats?

Lieutenant General DICKINSON. The Army's current plan for IFPC is a 2021 IOC. In the interim, the Army has existing, fielded Cruise Missile Defense (CMD) and Counter-RAM (C–RAM) capabilities provided by the Patriot Weapon System and the Land-Based Phalanx Weapon System (LPWS). The Army has previously considered numerous alternatives including Iron Dome and NASAMS but none of the systems meet all current requirements. The Army continues to evaluate options to accelerate C–RAM capability into IFPC via the competitive Enhanced Mission Area Missile (EMAM) effort for the second IFPC missile.

QUESTIONS SUBMITTED BY SENATOR MARTIN HEINRICH

MISSILE DEFENSE—LEFT OF LAUNCH

4. Senator HEINRICH. Secretary Rood, General Robinson, Lieutenant General Greaves, and Lieutenant General Dickinson, I believe there is a growing recognition that we are on the wrong side of the cost curve when it comes to missile defense. What sort of priority will the Missile Defense Review give to left-of-launch capabilities?

Secretary ROOD. The Missile Defense Review takes a comprehensive look at U.S. missile defense capabilities. This includes capabilities for deterrence, active and passive missile defense, and attack operations to destroy offensive missiles and their infrastructure prior to launch. Capabilities for attack operations, in particular, increase overall missile defense effectiveness, and lighten the burden on active and passive missile defense by reducing the number of offensive missiles that the adversary can launch. To strengthen U.S. capabilities for attack operations the United States will invest in: all-weather intelligence, surveillance, and reconnaissance platforms, information systems for rapid targeting, and prompt strike capabilities.

General ROBINSON. Lieutenant General Greaves and Lieutenant General Dickinson, as the Commander of U.S. Northern Command, my focus is on right-of-launch capabilities since my ballistic missile mission is defensive in nature. We are on the right path to increase the capabilities and capacity of the Ballistic Missile Defense System and improve engagement efficiency without sacrificing effectiveness. I defer assessments of left-of-launch capabilities to those Commanders whose mission includes offense.

Lieutenant General GREAVES. The Missile Defense Agency (MDA) defers to the Secretary of Defense to set the priority for left-of-launch capabilities in the Missile Defense Review.

Lieutenant General DICKINSON. As highlighted in my written statement, with the continued advancement of global missile threats, I believe it prudent to pursue holistic missile defense approaches, to include left-of-launch capabilities. The Missile Defense Review is in senior level staffing. I respectfully defer any questions regarding priorities to OSD Policy.

5. Senator HEINRICH. Secretary Rood, General Robinson, Lieutenant General Greaves, and Lieutenant General Dickinson, given that the fiscal year 2019 budget was submitted prior to the MDR release, should Congress expect a supplemental budget request to account for any increased investment in left-of-launch capabilities?

Secretary ROOD. The Missile Defense Review is nearing completion and will be released in a few weeks. As a result, it is premature to comment on the need for an fiscal year (FY) 2019 supplement budget request at this time. The Department fully supports the fiscal year 2019 President's Budget request.

General ROBINSON. I defer to Secretary Rood and Lt. Gen. Greaves on budget sufficiency for left-of-launch capabilities.

Lieutenant General GREAVES. The Missile Defense Agency (MDA) defers to the Secretary of Defense with regard to the submission of any fiscal year 2019 supplemental budget requests.

Lieutenant General DICKINSON. The Missile Defense Review is in senior level staffing. I respectfully defer any questions regarding its contents to OSD Policy.

BOOST PHASE INTERCEPT

6. Senator HEINRICH. Lieutenant General Greaves, I am glad to see you are looking at directed energy technology to address emerging threats like hypersonic vehicles and cruise missiles. I continue to believe that directed energy is a potential option to achieve a viable boost phase intercept capability. I am particularly interested in the Request for Information (RFI) that the Missile Defense Agency put out last summer for a high altitude long endurance (HALE) unmanned aircraft to carry a high-energy laser system. What were the results of that request, what is the status of the RFI, and what is MDA's plan moving forward?

Lieutenant General GREAVES. The High Altitude Long Endurance (HALE) unmanned aircraft is an essential component for the Missile Defense Agency (MDA) to achieve a viable Boost Phase Intercept (BPI) capability. Ten contractors responded to the HALE Request for Information (RFI) with 26 different concepts varying from near-term concepts providing modest performance improvements to far-term platforms meeting MDA's objective BPI performance requirements for altitude, payload and endurance. The RFI responses provided MDA several potential paths forward with varying degrees of cost, schedule and technical risk. MDA is using the results to inform both BPI planning and laser scaling size, weight and power requirements for mid and far-term potential capabilities. The next step is for MDA to solicit HALE concept designs from industry through a Broad Agency Announcement (BAA). The schedule for this effort is under development.

LASER SCALING

7. Senator HEINRICH. Lieutenant General Greaves, the MDA's unfunded priorities this year include Laser Scaling in order to continue research and development of three separate laser scaling efforts with the goal of demonstrating a 500 kilowatt (kW) laser by 2022 and a best of breed 1 Megawatt (MW) laser capability by 2024. Can you update the committee on the competing laser scaling efforts underway today?

Lieutenant General GREAVES. MDA continues to fund Diode Pumped Alkali Laser (DPAL) and Fiber Combining Laser (FCL) technologies at Lawrence Livermore National laboratory and MIT Lincoln Laboratory respectively. Both technologies have the potential to meet missile defense laser power, efficiency, beam quality and weight requirements. Both are demonstrating 30 kilowatt-class compact systems with excellent beam quality this year. The Agency is also interested in a third technology, Distributed Gain Laser (DGL). Initially this DARPA funded, General Atomics developed approach is currently operating at higher power levels with MDA funding the beam quality improvements.

8. Senator HEINRICH. Lieutenant General Greaves, is there value in having three separate laser scaling efforts, or should we be concentrating our resources on two competing lines of effort?

Lieutenant General GREAVES. Yes, there is value to funding three separate laser scaling efforts. Each laser uses a distinct technology approach and each approach has unique benefits and different technical risks. The DPAL shorter wavelength benefits missile defense, fiber lasers have high intrinsic beam quality and DGL's are ahead on power scaling but have beam quality risks. MDA's combination of requirements is stressing. Parallel demonstrations, which incrementally increase power while demonstrating high efficiency and excellent beam quality, increase confidence in reaching the missile defense laser requirements because the risks along the three paths are different. Each laser scaling demonstration activity could also spin off significant technology advances for multiple DOD missions.

QUESTIONS SUBMITTED BY SENATOR ELIZABETH WARREN

TRANSPARENCY IN MISSILE DEFENSE TESTING

9. Senator WARREN. Lieutenant General Greaves, according to an article that was published last month, you discussed plans to change how you report Missile Defense

Agency testing plans to the public. According to this article, you previously provided the name of the planned test event, the objective of the test, and a three-month window during which the test would take place. But last month you told Inside Defense that you would no longer release that information because of "the need to safeguard critical defense information."

What has changed in the threat picture that makes it necessary to withhold this information?

Lieutenant General GREAVES. [Deleted.]

10. Senator WARREN. Lieutenant General Greaves, what is the military benefit of withholding basic test information—like the high-level objectives or the season in which a test will take place—from independent observers?

Lieutenant General GREAVES. [Deleted.]

11. Senator WARREN. Lieutenant General Greaves, understanding we cannot hide these tests because they can be seen from space, isn't there some deterrence value in letting our adversaries know that we are actively working to improve our missile defense systems? Please explain your view.

Lieutenant General GREAVES. [Deleted.]

HOMELAND DEFENSE RADAR—HAWAII

12. Senator WARREN. Lieutenant General Greaves, in May 2017, the Government Accountability Office put out a report on the Missile Defense Agency's progress in achieving its acquisition goals and objectives. The report praises MDA for using "best practices" and "a sound business case" in developing its next generation of capabilities. The report also found that MDA's process "lacks . . . sufficient input from Department of Defense components." Specifically, GAO said that by not consulting more with the Army, Navy, Air Force and Marines, MDA risks investing in "solutions that are unnecessary, insufficient, or not a priority." GAO said that multiple DOD officials warned that MDA was making "trade-offs [that] compromise performance and reliability, potentially resulting in the warfighter receiving capabilities that are insufficient to defeat the threat."

How is MDA working with the military services to ensure that we get systems that meet their needs, and that we don't end up with multiple systems with similar requirements and mission sets?

Lieutenant General GREAVES. MDA works collaboratively with the military services to meet their requirements and prevent duplication of effort. MDA receives feedback and priorities through the United States Strategic Command-Approved Warfighter Involvement Process. In addition, MDA leadership coordinates and communicates with the Services through the Missile Defense Executive Board and Board of Directors meetings, which are held quarterly with the Army, Navy, and Air Force to review development activities for new Ballistic Missile Defense System systems, including the HDR–H and HDR–P. Both radars were requested by United States Pacific Command and United States Northern Command leadership to fill capability gaps identified in the Global Sensors Analysis of Alternatives, which was completed in 2016. MDA has engaged with the Air Force in the early planning stages for both radars, to include the ability to support other mission sets such as space situational awareness, and is working with the Department to have a lead Service designated.

13. Senator WARREN. Lieutenant General Greaves, the MDA is currently in the process of acquiring a new discrimination radar for Hawaii and Japan, called the Homeland Defense Radar. I recently sent you a letter about MDA's acquisition strategy for this radar and others in the Pacific. Are you willing to come brief me on your acquisition strategy for additional radars in the region?

Lieutenant General GREAVES. Yes. We would welcome the opportunity to brief you on the Homeland Defense Radar acquisition strategy.

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2019 AND THE FUTURE YEARS DEFENSE PROGRAM

WEDNESDAY, APRIL 11, 2018

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

U.S. NUCLEAR WEAPONS POLICY, PROGRAMS, AND STRATEGY

The subcommittee met, pursuant to notice, at 2:32 p.m. in Room SR–222, Russell Senate Office Building, Senator Deb Fischer presiding.

Members present: Senators Fischer, Cotton, Sullivan, Donnelly, Warren, and Peters.

OPENING STATEMENT OF SENATOR DEB FISCHER

Senator FISCHER. The hearing will come to order.

The subcommittee meets today to receive testimony on United States nuclear weapons policy, programs, and strategy in review of the Administration's fiscal year 2019 budget request.

I thank the witnesses for being with us today.

General Rand and Admiral Benedict, this will likely be the final time you appear before this subcommittee. Congratulations to you both on your upcoming retirements. We've enjoyed working with you and benefitted from your testimony these past years. This Nation owes you both a deep debt of gratitude for your four decades of military service. Gentlemen, I thank you.

[Applause.]

Senator FISCHER. Secretary Roberts and Dr. Soofer, thank you for joining us today. We look forward to hearing from both of you on how the budget supports the policies described in the Administration's Nuclear Posture Review, as well as the broader actions being taken to implement the NPR [Nuclear Posture Review].

I also want to compliment both of you for your work on the NPR. Since its release, critics have made a number of claims about its contents ranging from allegations that it lowers the threshold for nuclear use by proposing the employment of nuclear weapons in response to cyber attacks, to assertions that it initiates a new global arms race. Over the hearings and classified briefings we have held

this year, we have explored many of these criticisms and often found that the truth is far less dramatic.

Instead, the 2018 NPR continues many of the policies established in previous NPRs and plans put in place by the Obama Administration, such as the modernization of our nuclear forces. In the areas where it calls for change, such as the introduction of two supplemental systems, the NPR makes a clear case that the threats to our Nation have changed over the last 10 years and our Nation's deterrence posture must adapt accordingly.

Dr. Soofer, we look forward to hearing more on this topic from you, sir.

Again, I thank the panel for being with us today. We look forward to your comments and to your full statements, and those full statements will be made part of the record.

With that, I would like to recognize the Ranking Member, Senator Donnelly, for any opening remarks that he would like to make.

Senator?

STATEMENT OF SENATOR JOE DONNELLY

Senator DONNELLY. Thank you, Madam Chair, and thanks for holding today's hearing, and to our witnesses for being here.

Let me start out, as our Chair did, by noting that this will be the last time we have testimony from two friends of the subcommittee: General Robin Rand, the Commander of Air Force Global Strike Command, having served in the Air Force for 44 years—amazing, thank you so much—and Vice Admiral Terry Benedict, the Director of the Navy Strategic Systems Program, having served 41 years in the United States Navy. The Admiral said 41 years in the Navy is equivalent to 44 years in the Air Force.

[Laughter.]

Senator DONNELLY. That's a joke, for the record.

Both of you came to your leadership positions when our DOD [Department of Defense] nuclear program was undergoing great change and attention, and both of you, in my opinion, have been an amazing credit to the airmen and seamen who perform our nuclear deterrence mission 24/7, 365 days a year. I want to thank you for your service and wish you the best.

Today's hearing is focused on DOD's nuclear weapons policy for fiscal year 2019. If we include the full cost of the B–21 bomber, the Department will be requesting about $22.1 billion for nuclear modernization and operations, or, as Dr. Soofer likes to say, about 3 percent of the fiscal year 2019 DOD budget. We are told in peak years it will rise to about 6 to 7 percent.

That 6 to 7 percent deters a threat that is existential to our homeland, and our job in Congress is to ensure those dollars are well spent. It's in that regard that I'll ask questions on programs and operations for fiscal year 2019.

Also of interest is the 2018 Nuclear Posture Review. It has many features similar to the 2010 Nuclear Posture Review and retains the same negative use assurance in that we will not use nuclear weapons against nations in good standing with the Nuclear Nonproliferation Treaty but reserve the right to do so under extreme circumstances. It keeps our commitment to the Nuclear Non-

proliferation Treaty and to nonproliferation in general but recognizes the changed threat environment as compared to 2010.

Of interest will be the proposal for two supplemental systems, one a low-yield submarine-launched ballistic missile, and the other the bringing back of a sea-launched cruise missile which was dropped in the 2010 NPR as it was not maintained in storage stateside. My understanding is this action upset Japan and South Korea, so that additional aspect needs to be taken into account when we consider this proposal, along with the programmatic and policy, force structure, and budget impacts.

With that, let me thank everyone for coming today, and thank you, Madam Chair, for holding this hearing.

Senator FISCHER. Thank you, Senator Donnelly.

With that, I would ask for opening comments by members of the panel. My apologies.

Secretary Roberts?

STATEMENT OF HONORABLE GUY B. ROBERTS, ASSISTANT SECRETARY OF DEFENSE FOR NUCLEAR, CHEMICAL, AND BIOLOGICAL DEFENSE PROGRAMS

Secretary ROBERTS. Thank you, Chairman Fischer, Ranking Member Donnelly. Thank you for this opportunity again to testify before you today on the fiscal year 2019 budget request for nuclear forces. I'm pleased to join Vice Admiral Terry Benedict, General Robin Rand, and Dr. Soofer to discuss one of the Department of Defense's highest priorities.

As the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs and the Staff Director for the Nuclear Weapons Council, I oversee the Department's efforts to ensure the U.S. nuclear deterrent is safe, secure, ready, and effective, developing and sustaining capabilities to counter weapons of mass destruction threats, effects, and proliferation, and ensure DOD compliance with nuclear, chemical, and biological treaties and agreements.

Since the Cold War, the U.S. has reduced its nuclear stockpile by over 85 percent and deployed no new nuclear capabilities. Meanwhile, our adversaries have modernized their weapons systems and developed new capabilities while reducing transparency. With the return of Great Power competition and emerging nuclear threats, it is important to ensure our Nation's nuclear stockpile and infrastructure are prepared to provide a credible, flexible, ready, and technologically advanced deterrent that is resilient to technical and geopolitical change. The ability to effectively deter threats to our Nation's security relies on a diverse nuclear force with the flexibility to deliver tailored effects quickly and credibly. We now face a challenging task to counter and deter a wide range of current and emerging threats in an environment of increased uncertainty and risk. We must prepare to deploy a tailored and flexible nuclear deterrent as we face modern challenges and hedge against an uncertain future.

Over the past several decades, our nuclear weapons infrastructure has suffered the ravages of time and a lack of a comprehensive investment. Many of the specialized capabilities required for stockpile work have atrophied or become obsolete.

Our effort to reestablish our production capabilities at sufficient rates must be a national priority. As an integrated enterprise, we are focused on developing and executing a plan to meet stockpile needs and establish a path forward to manufacturing critical materials and components to meet future deterrent requirements.

While our nuclear triad forms the core of our deterrent, it is further strengthened by denying any potential adversary the perceived benefits of nuclear use. By ensuring that United States Forces and infrastructure are able to survive and operate through nuclear attack, we remove the incentive an adversary may have to launch such an attack in the first place. They demonstrate that aggression of any kind is not a rational option.

Our efforts to counter nuclear threats and respond to post-detonation scenarios, as well as supporting nuclear nonproliferation efforts, allow for improved responsiveness in-theater and flexibility for U.S. Forces to safeguard our weapons systems, delivery platforms, and personnel overseas.

Our fiscal year 2019 budget request is critically important for sustaining and revitalizing the Nation's nuclear deterrent in all its forms. It includes funding for sustaining and modernizing our nuclear forces and addressing military requirements in a complex and changing security environment.

We ask that you support both the Department of Defense and Department of Energy National Nuclear Security Administration's budget request as we continue to work closely to deter potential adversaries, meet emerging threats, assure our allies, and hedge against an uncertain future. I thank you very much for the committee's time, support, and leadership. Thank you.

[The prepared statement of Secretary Roberts follows:]

PREPARED STATEMENT BY SECRETARY GUY B. ROBERTS

Chairman Fischer, Ranking Member Donnelly, and distinguished members of the Subcommittee, thank you for the opportunity to testify before you today on the fiscal year (FY) 2019 budget request for nuclear forces. I am pleased to join Gen Robin Rand, VADM Terry Benedict, and Dr. Robert Soofer to discuss one of the Department of Defense's (DOD) highest priorities: ensuring that the Nation has a flexible, adaptable, and resilient nuclear deterrent in an increasingly complex and demanding security environment.

As the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs and the Staff Director of the Nuclear Weapons Council (NWC), I work directly for the Under Secretary of Defense for Acquisition and Sustainment (A&S), and advise the Department's senior leadership on nuclear matters. The Under Secretary leads the Department's efforts to acquire nuclear weapons delivery, and command and control systems required to meet the operational needs of our Armed Forces. The Under Secretary also chairs the NWC, a DOD and Department of Energy (DOE)/National Nuclear Security Administration (NNSA) governance body established to facilitate cooperation and coordination, reach consensus, and establish agreed-upon priorities as the Departments fulfill their shared responsibilities for United States nuclear weapons stockpile management. The NWC is deeply involved in balancing the need to maintain our existing nuclear weapons stockpile while modernizing that stockpile to ensure the long-term credibility and effectiveness of the nuclear deterrent, updating aging infrastructure, and preserving the human capital that underpins our capability to be a nuclear weapons state.

Global threat conditions have worsened markedly since the 2010 Nuclear Posture Review (NPR), and the United States and our allies now face an unprecedented range of threats, requiring a diverse set of nuclear capabilities to maintain a credible deterrent. The 2018 NPR tasks DOD and DOE/NNSA with ensuring the Nation is prepared to support a tailored and flexible nuclear deterrent to face modern challenges and to hedge against an uncertain future.

Our budget request demonstrates the Department's commitment to strengthening and modernizing the nuclear Triad and revitalizing the aging infrastructure that supports the nuclear security enterprise. Today, I will summarize the DOD perspectives on, and priorities for, warhead life extension, nuclear weapon delivery systems modernization and replacement, nuclear enterprise infrastructure modernization, stockpile sustainment, nuclear command and control, and communications (NC3), allied engagements specifically with NATO and in the Asia-Pacific region, as well as the challenges we face today and tomorrow to address emerging threats and ensuring a credible nuclear deterrent. While estimates of the cost to sustain and replace United States nuclear capabilities vary, according to our analysis, nuclear spending will reach a peak of approximately 6.4 percent of the overall DOD budget by the late 2020s, which compares favorably to the 10.6 percent of the DOD budget required during the 1980s and 17.1 percent in the 1960s. To ensure the continued credibility and reliability of our nuclear deterrent in an increasingly complicated and challenging world, it is essential that Congress support the President's fiscal year 2019 budget request for nuclear deterrence activities.

NUCLEAR ENTERPRISE CHALLENGES

Since the height of the Cold War, the United States has reduced the nuclear stockpile by over 85 percent and deployed no new nuclear capabilities. Meanwhile, Russia has modernized its non-strategic and strategic systems and developed new capabilities to bolster its nuclear Triad while instituting a military doctrine predicated on an "escalate to de-escalate" strategy. China has pursued new capabilities by modernizing and expanding its nuclear forces, developing and deploying new ground-based and sea-based nuclear delivery vehicles, all while displaying a lack of transparency in its nuclear force posture. Finally, North Korea's rapid progress with its nuclear weapons and missile programs also poses a significant security challenge.

With the return of Great Power competition and emerging nuclear threats, it is important, now more than ever, to ensure our Nation's nuclear stockpile, and infrastructure are prepared to provide a credible, flexible, ready, and technologically advanced deterrent for United States, allies, and partner security. To this end, the NWC regularly convenes to ensure synchronization between the Departments of Defense and Energy on the vision, strategy, and execution of nuclear programs. Specifically, the Council focuses its attention on nuclear enterprise challenges in four vital areas. First, the DOD must address the challenges of sustaining and modernizing all parts of our nuclear force structure, ensuring that the Nation's nuclear weapons sustainment and delivery system modernization programs are funded and aligned. Second, we must remain steadfast in our commitment to sustain and modernize our aging infrastructure, which provides materials, components, and testing facilities essential to our nuclear deterrent. Third, we must maintain and strengthen our ability to extend the lives of aging warheads, as the majority of today's nuclear weapons and delivery systems have surpassed their initial design life. This is accomplished through a robust program of science-based stockpile stewardship, as well as comprehensive component reuse, refurbishment, and replacement, while we ensure alignment with existing and future delivery systems. Fourth, we must continuously improve the rigorous science and engineering tools required to assess the safety and effectiveness of our aging nuclear weapons stockpile.

One of our significant internal challenges has been our lack of development of new capabilities to address the changing threat. We must be capable of developing and deploying new capabilities, when necessary, to deter adversaries, assure allies, achieve United States objectives if deterrence fails, and to hedge against uncertainty. Our future stockpile must be flexible, adaptable, and resilient to technological and geopolitical change.

DOD STOCKPILE REQUIREMENTS

"The United States will sustain a nuclear force structure that meets our current needs and addresses unanticipated risks. The United States does not need to match the nuclear arsenals of other powers, but we must sustain a stockpile that can deter adversaries, assure allies and partners, and achieve U.S. objectives if deterrence fails."
– (National Security Strategy, page 30)

Our nuclear deterrent is based on the capability to maintain and modernize our nuclear stockpile. To support this and remain consistent with past efforts, reflective of the priorities identified in the 2018 NPR, the NWC aligns warhead plans and infrastructure needs with delivery system modernization and replacement efforts.

We must sustain our current stockpile in order to avoid gaps in fulfilling military requirements, while developing the expanded capabilities identified in the 2018 NPR. NNSA's science-based Stockpile Stewardship Program has ensured confidence in the reliability of the current nuclear stockpile without nuclear explosive testing. The Stockpile Stewardship Program, composed of research, development, test, and evaluation (RDT&E) facilities and personnel, enables the surveillance and assessment of the stockpile's condition by identifying anomalies, evaluating impacts of anomalies on warhead performance, and implementing solutions.

To address supplemental capabilities, the NWC will coordinate the near-term plans to modify a small number of existing submarine-launched ballistic missile (SLBM) warheads to provide a prompt low-yield option, and in the longer term, to pursue a modern nuclear-armed sea-launched cruise missile (SLCM). The low-yield SLBM warhead and SLCM will provide additional diversity in platforms, range, and survivability, as well as a valuable hedge against future nuclear "break out" scenarios, without impacting our obligations under bilateral nuclear arms control agreements, such as the Intermediate-range Nuclear Forces (INF) and New START treaties.

REVITALIZING THE NUCLEAR INFRASTRUCTURE

"Our nuclear deterrent is nearing a crossroads. To date, we have preserved this deterrent by extending the lifespan of legacy nuclear forces and infrastructure-in many cases for decades beyond what was originally intended. But these systems will not remain viable indefinitely. In fact, we are now at a point where we must concurrently modernize the entire nuclear triad and the infrastructure that enables its effectiveness."
– Vice Chairman, Joint Chiefs of Staff, General Paul Selva, 2017

The current global threat environment and an uncertain future now necessitate a national commitment to maintain modern and effective nuclear forces, as well as the infrastructure needed to support them. Over the past several decades, our nuclear weapons infrastructure has suffered the ravages of time and a lack of comprehensive investment. Our nuclear enterprise infrastructure challenges are twofold: 1) working to achieve an infrastructure more responsive to nuclear deterrent requirements, and 2) addressing aged, end-of-life facilities maintenance, recapitalization, and replacement. Many of the specialized capabilities required for stockpile work have atrophied or become obsolete. As a result, the dedicated personnel at our national security laboratories and production facilities have not been able to process or manufacture many of the required strategic materials and critical components in quantities necessary to sustain our stockpile.

Our effort to re-establish our production capabilities at sufficient rates must be a national priority. The NWC is focused specifically on plutonium, uranium, lithium, and tritium capabilities, as well as radiation-hardened microelectronics manufacturing capabilities needed to support the current and future nuclear weapons stockpile. The Department of Defense reinforces NNSA's commitment to develop a responsive and productive strategic materials plan to meet stockpile needs and establish a path forward to manufacturing critical materials to meet future deterrent requirements.

Through the Stockpile Responsiveness Program (SRP), established by Congress with bipartisan support, NNSA sustains the nuclear weapons design and development skills needed by its workforce to address evolving threats and the potential for technological surprise. The SRP expands opportunities for scientists and engineers to advance such skills, which have not been fully developed or exercised in the current programs of warhead assessment, maintenance, and life extension. Maintaining these skills is an important element of the U.S. hedging strategy in order to provide timely availability of capabilities, if needed to meet changes in the security environment.

A key element in establishing a robust production capability is attracting top talent. Talent is being lost to non-defense industries due to unacceptable, extended delays in the security clearance process. Personnel shortages are contributing to national security risks as positions go unfilled and mission performance is comprised. Unfilled positions in the nuclear enterprise due to security clearance process delays will have an impact on our ability to meet our goals. This is a serious national security issue with strategic implications. .

An assured, reliable, and resilient NC3 system that operates across the full spectrum of conflict is essential in today's complex security environment. As we modernize our nuclear forces, we must also modernize our NC3 systems to enhance deterrence. An effective NC3 architecture must support a tailored deterrence strategy for each potential adversary, allowing for flexible response options to various provo-

cations, and enabling adjustments to our deterrent posture over time to face emerging threats. Robust NC3 ensures the United States receives indications and warning in a timely manner, and provides decision-makers with the necessary time to make informed decisions and employ our forces in extreme circumstances.

DOD DELIVERY SYSTEM REQUIREMENTS

The ability to effectively deter threats to our Nation's security relies on maintaining a nuclear force with a diverse, flexible range of yield and delivery modes that are ready, capable, and credible. While the delivery systems underlying our nuclear triad remain effective today, the Department is entering a period when all legs of the triad, to include delivery platforms, will require significant modernization or replacement to sustain these capabilities. Since most of the Nation's nuclear deterrence delivery systems were built in the 1980s or earlier, they will begin to age out or face decreasing effectiveness by the mid-2020s. As the 2018 NPR reaffirms, we must recapitalize our legacy nuclear deterrence forces now and continue the modernization program initiated during the previous Administration.

To this end, the fiscal year 2019 budget request funds all critical DOD nuclear modernization requirements, ensuring that modern replacements will be available before the our legacy systems reach the end of their sustainability. DOD continues to pursue a robust plan for recapitalizing ballistic missile submarines (SSBNs), submarine-launched ballistic missiles (SLBMs), intercontinental ballistic missiles (ICBMs), air-launched cruise missiles, and nuclear-capable heavy bombers and their associated gravity bombs that comprise our strategic nuclear deterrent. Our budget request is consistent with our plans to ensure that current nuclear delivery systems will be sustained, and the weapons and delivery platforms modernization and replacement programs are integrated, executable and on-schedule to avoid capability gaps.

Modernization and replacement programs will require increased investment over current levels for next 15 years or more. We are taking steps to control the costs of these efforts, such as ensuring weapon system component commonality to a practical extent and close alignment between DOD delivery systems and NNSA warhead programs. We will continue to monitor the progress of both the weapons and platform programs to ensure the long-term viability of the nuclear deterrent.

ALLY ENGAGEMENTS AND EXTENDED DETERRENCE

Effective deterrence is the foundation for effective assurance. Our ability to continue assuring allies depends on the credibility of our nuclear capability and extended deterrence. As such, we must develop the necessary infrastructure, capabilities, and political agreements, to address nuclear threats or nuclear use now and in the future.

In addition to our deterrence and assurance posture in Europe, our nuclear forces provide a worldwide deterrent posture. The United States will maintain a spectrum of capabilities to ensure that no adversary perceives an advantage in nuclear escalation. These capabilities run the full spectrum of options to assure our allies in both Europe and the Pacific.

The United States must and will continue to maintain a credible forward deployed nuclear deterrent capability. Together with our allies in Europe and the Pacific, maintaining a strong, cohesive alliance is the most effective way of deterring aggression from potential adversaries and promoting peace throughout the world. This posture demonstrated that aggression of any kind is not a rational option. Essential to these objectives is ensuring that upgrades and replacements for our legacy forward-deployed dual capable aircraft (DCA) and associated B61 gravity bombs remain capable of convincing our adversaries that prospective benefits of aggression are outweighed by the consequences.

As we prepare for the modernization of nuclear weapons that will later be deployed within the European theater, we have partnered with our allies and with United States European Command to conduct an exercise that will ensure both the United States and the host nation can respond to high consequence/low probability scenarios. This exercise, to be conducted later this year, will guarantee our readiness as a joint and interagency emergency response force and will set the stage for future "whole-of-government" events.

From a modernization perspective, with the B61–12 life extension program on schedule, we are working with our allies in planning the upcoming deployment of this enhanced capability. We continue to monitor the Air Force's progress on nuclear certification of the F–35 and look forward to what this 5th generation fighter will do to solidify our DCA capabilities for the United States and NATO.

At the NATO High Level Group, for which I serve as the Vice Chairman for Safety, Security, and Survivability, we've had the opportunity to interact with our European counterparts and have informed them of the various advancements being made within the nuclear security arena. We continue to move with alacrity on our planned Weapons Storage and Security System life extension program, which furthers our ability to secure our nuclear assets well into the future. Although moving cautiously to ensure proper technology maturation, we continue to make progress on fielding additional security technologies and capabilities with the assistance of NATO, which will allow both United States and host nation security forces to keep pace with emerging and asymmetric threats. Since 2000, NATO has invested over $271 million dollars in security upgrades and another security capability package was approved in December 2017.

NUCLEAR SECURITY AND SAFETY

In additional to modernizing our nuclear deterrence and providing assurance to our allies and partners, we continue efforts to create a more cooperative and collaborative physical security environment for our nuclear facilities at home and overseas. We continuously review our policies ensuring our nuclear deterrent remains safe, secure, and effective in a changing security environment, while allowing for flexibility in the implementation by the Services and DOD components. Part of our responsibility is to oversee the Mighty Guardian series of physical security exercises designed to test DOD policy against evolving threats. These threats can be both foreign and domestic and include evaluating new and emerging technologies, such as unmanned systems. We recently concluded an exercise overseas and are in the final planning phases of executing another exercise here within the United States. To date, we have executed 18 exercises, all of which have resulted in enhancing our security posture through the years.

Further, we invest approximately $40 million per year in both nuclear and conventional physical security efforts through the Physical Security Enterprise and Analysis Group. Our office works with the Military Departments and the interagency to identify and eliminate gaps in our ability to detect, delay, deny, defeat, and ultimately deter threats to our vital assets.

NUCLEAR SURVIVABILITY

While our nuclear triad forms the core of our deterrent, it is further strengthened by denying any potential adversary the perceived benefits of nuclear use. By ensuring that United States Forces and infrastructure are able to survive and operate through nuclear attack, we remove the incentive an adversary may have to launch such an attack in the first place. To that end, we are working to improve the survivability of United States nuclear and conventional systems to nuclear effects, including high-altitude electromagnetic pulse (EMP). In particular, we are working with Joint Staff to improve how we address nuclear survivability beginning early in the acquisition process, for example the hardening of the Marine Corps' new Presidential helicopter. We are beginning to recapitalize our test and evaluation capabilities as hardened systems are developed and fielded. In addition, we will support the efforts of the EMP Commission established by Congress last year to assess the threat of EMP attacks on the United States, and I look forward to its findings and recommendations.

COUNTERING NUCLEAR THREATS

While maintaining a credible national and extended deterrent is our top priority, we should be mindful not to ignore the importance of countering potential threats from non-state actors. Combatting weapons of mass destruction (WMD) requires a strategy that leverages a wide range of activities and capabilities integrated through a multilayered approach. The United States strives to prevent malicious actors from obtaining nuclear weapons or weapons-usable materials, technology, and expertise; counter non-state actor's efforts to acquire, transfer, or employ these assets; and respond to nuclear incidents, by locating and disabling a nuclear device or managing the consequences of a nuclear detonation both on the battlefield and in a civil setting.

The fiscal year 2019 budget request for Countering Nuclear Threats (CNT) continues to focus on interoperability and survivability, with programs to provide the Services with radiation-hardened, common equipment, including capabilities for rapid post-detonation deployment. These systems support a variety of missions, including recovery of material after a nuclear weapons accident, contamination avoidance on the nuclear battlefield, decontamination verification both on the nuclear

battlefield and in support of consequence management missions, as well as verification that platforms and materiel meet radiological release criteria.

In addition, the Department of Defense is working with its interagency partners (NNSA, FBI, and DHS) and the national security laboratories on technical nuclear forensics (TNF) to rapidly collect and analyze samples for attribution in a nuclear event. This contributes to our deterrent strategy and has application beyond responding to a nuclear detonation, as it is invaluable to efforts such as treaty monitoring and understanding baseline environmental conditions.

As part of our efforts to deter future nuclear use, the United States remains deeply committed to nuclear nonproliferation efforts. Early warning of nuclear proliferation is a critical first step in our overall strategy. To facilitate this, we support partner nation capability building to improve responsiveness in theater and return flexibility to United States Forces in order to safeguard our weapons systems, delivery platforms, and personnel overseas.

CONCLUSION

As articulated in the 2018 NPR and National Defense Strategy, the United States now faces a more diverse and complex nuclear threat environment than ever before. In order to build a more lethal, resilient, ready, and rapidly innovating force in response to these emergent threats, we must continue to field a strong nuclear deterrent supported by an agile and responsive infrastructure, including a well-trained and sufficiently exercised nuclear enterprise workforce, undiminished by security clearance delays.

The President's Fiscal Year 2019 Budget Request supports our nuclear force strategy as our program of record evolves. It includes funding for sustaining and modernizing our nuclear forces, and addressing military requirements in a complex and changing security environment to deter potential adversaries and threats, assure allies, and hedges against an uncertain future. The Department of Defense remains committed to maintaining its close and vital partnerships with DOE/NNSA and Congress in meeting the Nation's fundamental security needs. In closing, we respectfully ask that you support the President's fiscal year 2019 nuclear forces' budget request.

Senator FISCHER. Thank you, Mr. Secretary.

Dr. Soofer?

STATEMENT OF ROBERT M. SOOFER, Ph.D., DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR NUCLEAR AND MISSILE DEFENSE POLICY

Dr. SOOFER. Thank you. Madam Chair, Ranking Member Donnelly, I thank you for the opportunity to testify today. With your permission, I'd like to submit a longer statement for the record and make a few opening remarks. Thank you.

Secretary Mattis, Under Secretary Rood, and General Selva have previously briefed the full committee on the 2018 *Nuclear Posture Review,* so I won't go into any great detail today. However, I would like to take a moment to summarize a few key points based on feedback we received from members of Congress, as well as our allies.

First, the findings and recommendations of the 2018 Nuclear Posture Review are well grounded in what has been a traditional bipartisan approach to nuclear policy, summarized by Secretary Mattis in his public remarks following the February meeting of NATO's [North Atlantic Treaty Organization] Nuclear Planning Group.

"The U.S. approach to nuclear deterrence," he said, "embraces two co-equal principles: first, ensuring a safe, secure, and effective nuclear deterrent; and second, working wherever possible for nuclear nonproliferation and arms control whenever it advances stability and security for us and our allies. Nuclear deterrence and ef-

forts to foreclose proliferation and reduce the number of nuclear weapons are not mutually exclusive."

Second, reflecting the priority afforded nuclear deterrence, the fiscal year 2019 budget request includes full funding for Department of Defense nuclear programs and is meant to maintain the nuclear modernization plans approved by Congress over the past years.

Third, despite what you may have seen in the press, our nuclear posture does not increase the circumstances under which our Nation would contemplate the use of nuclear weapons, nor do we increase reliance on nuclear weapons. Rather, we maintain the longstanding policy that "the United States would employ nuclear weapons only in extreme circumstances to defend the vital interests of the United States, allies, and partners." This recognizes the enduring role for nuclear weapons in deterring nuclear and conventional aggression and assuring allies, while hedging against an unpredictable security environment.

Fourth, the recommendation to pursue two supplemental capabilities to the existing nuclear force program of record will not increase the likelihood of nuclear war or stimulate an arms race. These recommendations include in the near term modifying a small number of existing submarine-launched ballistic missile warheads to lower their explosive yield, and in the mid-to-longer term pursuing a nuclear sea-launched cruise missile, a capability that existed in our arsenal until it was retired early in the prior administration when the security environment seemed more benign. Both these capabilities are in response to Russian nuclear doctrine and new nuclear capabilities that must be viewed in the broader context of the long-term competition between the United States and Russia identified in the 2018 National Defense Strategy.

These capabilities are also applicable to what appears to be China's growing nuclear forces that can threaten the United States and its allies in the Indo-Pacific region.

The supplemental capabilities are needed to ensure that Russian and Chinese leadership do not mistakenly conclude they could achieve some advantage by initiating a limited first use of nuclear weapons, potentially including low-yield weapons. It's not a radical departure from previous policy. It does not signify a shift to nuclear warfighting. Rather, it reinforces the imperative expressed by the previous administration to retain a range of nuclear capabilities in explosive power and methods of delivery to strengthen deterrence in a wide range of scenarios, including an adversary's calibrated nuclear escalation.

These two additional capabilities strengthen the credibility of our declaratory policy to counter any nuclear attack under any circumstance, which in turn raises the nuclear threshold and strengthens deterrence by signaling to adversaries that they have nothing to gain through limited strikes and everything to lose.

Because these capabilities are consistent with existing arms control treaties and do not threaten Russian nuclear retaliatory forces, they should not stimulate an arms race. Rather, they could provide the means for addressing the growing disparity between Russia and the United States in nuclear forces not limited by existing nuclear treaties, a disparity that has been well recognized by Con-

gress and that will continue to grow in the future unless we create some point of leverage.

Fifth, throughout the Nuclear Posture Review we consulted extensively with allies and partners, and their reaction to the NPR has been positive. Asian and European allies recognize that the security environment has changed for the worse and requires an emphasis on nuclear deterrence even while we continue to pursue, where feasible, a balanced policy that combines effective deterrence with a broad-based effort to reduce nuclear risks through global nonproliferation initiatives and a responsible program of arms control.

Finally, I would add that, as noted by Secretary Mattis, the United States' commitment to arms control and nuclear nonproliferation remains strong, but arms control is not an end in itself and depends on the security environment and the participation of willing partners. Russia's significant non-compliance with the INF [Intermediate-Range Nuclear Forces] Treaty and buildup of nuclear weapons not limited under the New START [Strategic Arms Reduction Treaty] Treaty calls into question its willingness to be a serious partner in arms control. The United States remains committed to strategic dialogue when conditions permit.

I thank the committee for its strong bipartisan support of U.S. nuclear policies and modernization programs over the years and look forward to answering your questions. Thank you.

[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) 2019 Budget Request for Nuclear Forces and Atomic Energy Defense Activities.

THE CHANGING STRATEGIC ENVIRONMENT

Today, the United States faces an increasingly complex global security environment, in which the central challenge to our prosperity and security is the reemergence of long-term strategic competition by revisionist powers in China and Russia. The 2017 National Security Strategy observes that Russia and China are asserting their global and regional influence and are fielding military capabilities designed to deny the United States' ability to project power and defend our allies and partners in Europe and Asia respectively.

Long-term competition with China and Russia requires increased U.S and allied military investment because of the magnitude of the threats they pose today, and the potential that these threats will increase in the future. This is underscored in the 2018 National Defense Strategy, which asserts that we must also simultaneously strengthen our efforts to deter and counter the clear and present dangers posed by rogue regimes such as North Korea and Iran.

The United States for years worked to reduce the role and number of nuclear weapons worldwide, but potential adversaries have done the opposite. Over the past decade, they have vigorously pursued the modernization of their existing nuclear forces and the development and fielding of new nuclear capabilities. In some cases, they deliberately elevated and expanded the prominence of nuclear weapons in their military strategies. Nuclear weapons are seen as a useful means of political coercion and a potential source of military advantage, especially when facing an opposing force with far greater potential at the conventional level of war. It is no surprise, therefore, that Russia, China and North Korea, in particular are modernizing and expanding their nuclear arsenals.

THE NUCLEAR THREAT

The 2018 *Nuclear Posture Review* (NPR) reflects DOD's strategic priority to maintain a safe, secure, survivable and effective nuclear deterrent. The NPR used a

threat-based approach by examining the challenges posed by Russia, China, and other states' strategic policies, programs, and capabilities, particularly nuclear.

Russia

Russia is improving and expanding its nuclear capabilities with a large, diverse, and modern arsenal of strategic and non-strategic weapons. With non-strategic nuclear weapons numbering in the thousands, in addition to its strategic nuclear stockpile, Russia is widening the quantitative and qualitative gap between its nuclear arsenal and our own.

Russia's nonstrategic nuclear weapons provide a flexible, usable adjunct to its conventional forces to prevent battlefield defeat. Russia is modernizing an active stockpile of up to 2,000 such weapons that can be deployed on ships, bombers and tactical aircraft, and with ground forces. This includes short-range ballistic missiles, air-to-surface missiles, gravity bombs, torpedoes, and depth charges. Russia is also deploying a nuclear ground-launched cruise missile in violation of the 1987 Intermediate Nuclear Forces (INF) Treaty. By contrast, NATO's nonstrategic nuclear posture relies upon a modest number of gravity bombs and dual-capable tactical aircraft, capabilities that are being modernized but not expanded in size.

The asymmetry in nonstrategic nuclear weapons has always been a source of concern precisely because of the fear that it could contribute to regional deterrence instability. This is why we have consistently called for extending the bilateral arms control framework to include these forces. With equal consistency Russia has refused to consider these offers. Now, with its ongoing violation of the INF Treaty, Russia is poised to extend this asymmetry with the development, production, and fielding of a mobile ground-launched system that can quickly and reliably strike deep into NATO territory.

In support of these capabilities, Russia's military doctrine emphasizes the coercive nature and military value of nuclear weapons. During its invasion and illegal annexation of Crimea, Russia raised the alert of its nuclear forces and issued veiled nuclear threats to warn against Western intervention. Russia has repeatedly in recent years brandished its nuclear sword against our NATO allies, while Russian President Putin issued this past July an edict that "in conditions of a military conflict, demonstration of readiness and determination to use force by employment of a non-strategic nuclear weapon is an efficient deterrence factor."

This past month, NATO's Secretary General Jens Stoltenberg expressed, "Our concern [is] that Moscow has clearly stated in their doctrine that they are prepared to use nuclear weapons in regional conflicts . . . We see the danger that Russia could gradually move from using conventional weapons to nuclear weapons." Russian military doctrine allows for use of nuclear weapons on a limited scale with the goal of protecting Russian strategic and operational gains in a local aggression and deterring an effective NATO response. Russian leaders might execute such a strategy if they believed that it was their best chance to terminate or freeze a conflict on favorable terms—and that NATO and the United States would hesitate to respond in kind because most available nuclear options carry a high risk of further, unintended escalation or could be defeated by Russia's growing anti-access/area denial capabilities (e.g., advanced integrated air defenses). This approach, of course, is as risky as it is reckless—but Russian leaders could conclude the risk is acceptable if the stakes for Russia were sufficiently high and that they enjoyed "escalation advantage" at the nonstrategic nuclear level.

Our aim is to disabuse Russia of the notion that nuclear warfare is a viable option and to reinforce deterrence at all levels. We understand that the exact elements of Russia's nuclear doctrine are subject to public interpretation and debate—and that we cannot know with certainty what would trigger limited nuclear use against NATO. But given the stakes, it would not be responsible to base our policy on a benign reading of Moscow's intentions and how Russian leaders think about the nuclear threshold and the risks of escalation.

China

China is rapidly modernizing its strategic and non-strategic nuclear weapons as part of its efforts to prevent the United States from defending its allies and partners in the region. And, China continues to expand its nuclear capabilities in both quantity and quality. Since 2010, it has announced the development of or fielded new road-mobile and MIRV-capable ICBMs, theater-range ballistic missiles, a new SLBM, a new ballistic missile submarine, and the H–6K strategic bomber.

China's ICBMs and SLBMs are capable of reaching the United States, and nuclear-armed, theater-range ballistic missiles are capable of reaching U.S. territory, allies, partners, forces and regional bases. China's rapid military modernization, growing and diversifying nuclear arsenal, and assertive approach to expanding its

geopolitical power at the expense of the sovereignty of its neighbors undermine the stability of the Indo-Pacific region. Moreover, China's lack of transparency regarding the scope and scale of its nuclear modernization leaves the international community with concerns about its future intent.

North Korea

North Korea's continued pursuit of nuclear weapons, combined with frequent threats against the United States and our South Korean and Japanese allies, are a major challenge to peace and security in Northeast Asia and around the world. North Korea has dramatically increased its missile flight testing, including recent ICBM tests, and has conducted six nuclear tests since 2006. Just as concerning is North Korea's history of proliferating nuclear and missile technology.

Iran

Finally, Iran's continued efforts to destabilize its neighbors and support violent extremists undermine stability in the region. Iran's destabilizing regional actions, aggressive strategy, and development of increasingly longer-range missile capabilities calls into question its long-term commitment to foregoing nuclear weapons. Although Iran has agreed to constraints on its nuclear program in the Joint Comprehensive Plan of Action (JCPOA), it retains the technological capability and much of the capacity necessary to develop a nuclear weapon within one year of a decision to do so.

UNITED STATES NUCLEAR POLICY

The 2018 Nuclear Posture Review reflects the Department of Defense's strategic priority to maintain a safe, secure, survivable and effective nuclear deterrent. The highest U.S. nuclear policy and strategy priority is to deter potential adversaries from nuclear attack of any scale against the United States or its allies. However, deterring nuclear attack is not the sole purpose of nuclear weapons. Given the diverse threats and profound uncertainties of the current and future threat environment, U.S. nuclear forces play the following critical roles in U.S. national security strategy. They contribute to the:

- Deterrence of nuclear and non-nuclear attack
- Assurance of allies and partners
- Achievement of U.S. objectives if deterrence fails
- Capacity to hedge against an uncertain future

Effective U.S. deterrence of nuclear attack and non-nuclear strategic attack requires ensuring that potential adversaries do not miscalculate regarding the consequences of nuclear first use, either regionally or against the United States itself. They must understand that the costs far outweigh any perceived benefits from non-nuclear aggression or limited nuclear escalation.

The requirements for effective deterrence vary given the need to address the unique perceptions, goals, interests, strengths, strategies, and vulnerabilities of different potential adversaries. The deterrence strategy effective against one potential adversary may not deter another. Consequently, the United States will apply a tailored approach to effectively deter across a spectrum of adversaries, threats, and contexts.

Tailoring our deterrence strategy requires a diverse set of nuclear capabilities to provide the President the flexibility needed to address a spectrum of adversaries and threats and enable adjustments over time. Flexibility means having the appropriate range and mix of nuclear and other capabilities required to tailor deterrence strategies now and into the future.

The United States has understood the value of flexibility for nuclear deterrence for six decades, but its importance is now magnified by the emerging diversity of nuclear and non-nuclear strategic threats and the dynamism and uncertainties of the security environment. This need for flexibility to tailor U.S. capabilities and strategies to meet future requirements and unanticipated developments runs contrary to a rigid, continuing policy of "no new nuclear capabilities."

Potential adversaries do not stand still. On the contrary, they seek to identify and exploit weaknesses in U.S. capabilities and strategy. Thus, U.S. future force requirements for deterrence cannot prudently be considered fixed. The United States must be capable of developing and deploying new capabilities, if necessary, to deter, assure, or achieve U.S. objectives if deterrence fails, and hedge against uncertainty.

Declaratory Policy

U.S. nuclear declaratory policy is consistent with the 2010 NPR and states that "the United States would employ nuclear weapons only in extreme circumstance to defend the vital interests of the United States, allies and partners." The 2018 NPR

clarifies that the "extreme circumstances" that may lead the United States to consider nuclear use, include, but are not limited to: significant non-nuclear strategic attacks on U.S., allied, or partner civilian population or infrastructure; and significant non-nuclear strategic attacks on U.S. or allied nuclear forces, their command and control, or warning and attack assessment capabilities. This is not—as sometimes portrayed—an expansion of the circumstances under which the U.S. might consider the use of nuclear weapons, but rather a clarification intended to reduce the probability of adversary miscalculation.

The 2018 NPR further states that "The United States will not use or threaten to use nuclear weapons against non-nuclear weapons states that are party to the NPT and in compliance with their nuclear non-proliferation obligations."

UNITED STATES NUCLEAR POSTURE

The 2018 NPR confirms the findings of all previous NPRs that the diverse capabilities of the nuclear triad provide the flexibility and resilience needed for deterrence in the most cost-effective manner. Unfortunately, each leg of the triad is now operating far beyond its originally-planned service life. Consequently, we must not delay the recapitalization of the triad initiated by the previous Administration.

The fiscal year 2019 budget request funds all critical Department of Defense (DOD) modernization requirements, helping to ensure that modern replacements will be available before the Nation's legacy systems reach the end of their extended service lives. The fiscal year 2019 budget request for nuclear forces is $24 billion, which includes $11 billion for nuclear force sustainment and operations, $7 billion for recapitalization programs (including LRSO, B–21, GBSD, and the *Columbia*-class SSBN), and $6 billion for Nuclear Command, Control and Communications (including MILSATCOM).

The DOD request to recapitalize the nuclear enterprise in fiscal year 2019 is about 1.4 percent of the total DOD base budget. Overall, nuclear force modernization will cost approximately $320 billion over 23 years. At its highest level of funding in 2029, recent estimates, such as those from the 2018 Nuclear Posture Review, project that the total cost to sustain and modernize U.S. nuclear forces will account for about 6.4 percent of the Defense budget, returning to about 3 percent upon completion of modernization.

Supplemental Capabilities

The President's budget request includes two supplemental capabilities designed to enhance deterrence against emerging challenges in the near- and mid-term. The first of these is to modify a small number of existing submarine-launched ballistic missile (SLBM) warheads to provide a low-yield ballistic missile option in the near term. The Department requests $22.6 million in fiscal year 2019 to support integration of these warheads into the missile system. We also request funds of $1 million in fiscal year 2019 to initiate an analysis of the performance requirements and costs to pursue a modern nuclear-armed sea-launched cruise missile (SLCM) that could be available in the mid-term. This capability was previously fielded but retired in 2011 given the hope of a more benign security environment.

The modified SLBM warhead and a modern SLCM will provide additional low-yield employment capabilities that an adversary will have to consider if contemplating a limited use of nuclear weapons. They will also provide additional diversity in platforms, range, and survivability, and a valuable hedge against future nuclear "break out" scenarios. The SLCM also improves overall survivability of the deterrence force and provides additional assurance to allies. The availability of such systems will give an adversary pause, especially if paired with other demonstrations of U.S. and allied resolve, and thus lessen the risk of a catastrophic miscalculation. United States leadership will want options that are operationally effective and that signal unmistakably the will to defend vital interests and impose significant costs on an adversary—but that can be executed in a way that is perceptibly restrained and has some prospect of managing the risk of further escalation.

This is not a warfighting approach, but rather reinforces deterrence of conflict at the outset. The possession of potent, flexible nuclear capabilities can bolster deterrence by convincing adversaries not to initiate a conventional war in the first place, or by compelling them to accept conventional defeat rather than reaching for nuclear weapons.

These capabilities are consistent—and fully comply—with the New START Treaty and the INF Treaty. They will not add to the number of nuclear weapons in the U.S. nuclear stockpile or create pressures for an "arms race," and when fielded will not pose a threat to Russia's nuclear retaliatory capabilities. Deployed at sea, these systems will not place added burdens on allies for basing and support.

Some have suggested that low-yield nuclear weapons undermine deterrence by lowering the nuclear threshold and making nuclear war more likely. There is no empirical basis to this claim. The United States has long maintained a high threshold for nuclear use together with a diverse range of nuclear explosive yields and response options. These proposed supplements to our current strategic forces would contribute to deterrence by raising a potential adversaries' threshold for nuclear use. They would make nuclear war less, not more, likely by demonstrating to adversaries that the United States is fully prepared to deter nuclear threats at every stage of an escalating crisis or conflict.

This would help ensure that potential adversaries do not perceive an exploitable advantage in using low-yield nuclear weapons and thereby deny them confidence that their coercive threats of either limited nuclear first use or actual first use can provide a useful advantage over us and our allies. These supplements are not intended to mimic or match adversary nuclear capabilities. They can, nevertheless, counter Russian limited nuclear war doctrine, help address the imbalance in U.S. and Russian non-strategic nuclear forces, and may create incentives for Russia to return to compliance with its nuclear arms control commitments and reduce numbers of non-strategic nuclear weapons.

ARMS CONTROL AND NONPROLIFERATION

The U.S. commitment to nonproliferation and arms control remains strong. We value an integrated approach that combines effective deterrence with a broad-based effort to reduce nuclear risks through global nonproliferation initiatives and a responsible program of arms control. The United States remains committed to all of its obligations under the Nuclear Non-Proliferation Treaty, including Article VI. By providing a credible nuclear umbrella extended to over thirty allies and partners, the U.S. is meeting their need for nuclear deterrence and at the same time enabling them to forgo independent nuclear weapons capabilities.

Arms control can contribute to U.S., allied and partner security by helping to manage strategic competition among states. By codifying mutually agreed-upon nuclear postures in a verifiable and enforceable manner, arms control can help foster transparency, understanding, and predictability in adversary relations, thereby reducing the risk of misunderstanding and miscalculation.

Arms control, however, is not an end in itself, and depends on the security environment and the participation of willing partners. Russia continues to violate a series of arms control treaties and commitments, most significantly, its non-compliance with existing obligations under the Intermediate-Range Nuclear Forces (INF) Treaty and its failure to abide by its obligations under numerous agreements such as the Helsinki Accords, which established the inviolability of borders. Russia also refuses to address the disparity in the number of non-strategic nuclear weapons in its stockpiles as compared to the United States.

The United States does not wish to regard Russia as an adversary and seeks stable and productive relations. We remain committed to strategic dialogue when conditions permit and there is a meaningful prospect for positive outcomes. Given its actions in recent years, realistically the onus is on Russia to restore the basis for constructive engagement; if it does so, it will find a willing partner in NATO and the United States.

We understand the importance of a balanced policy that combines effective deterrence with a broad-based effort to reduce nuclear risks through global nonproliferation initiatives and a responsible program of arms control. This past February, Washington and Moscow announced that they had achieved the negotiated limits of the New START Treaty, codifying the lowest levels of strategic nuclear weapons since the era of bilateral nuclear arms control began. The Treaty remains in effect until 2021 unless a decision is made to extend it.

Today, however, it is difficult to envision further progress given Russia's significant non-compliance with its INF Treaty obligations and its refusal to discuss limits to nonstrategic nuclear weapons. Make no mistake, Russia's decision to violate the INF Treaty, regardless of the military implications, is a significant political act that calls into question its willingness to be a serious security partner. Still, the United States remains committed to finding a diplomatic solution that brings Russia back into full and verifiable compliance. The Alliance is united in this goal and this approach, as reflected in the 15 December 2017 statement by the North Atlantic Council on the INF Treaty. While the United States will continue to pursue a diplomatic solution, we are also implementing economic and military measures intended to induce the Russian Federation to return to compliance. This includes a review of military concepts and options, including options for conventionally-armed, ground-launched, intermediate-range missile systems.

It is useful to view the NPR initiatives in this light. U.S. resolve to maintain modern nuclear forces and prevent destabilizing force imbalances from emerging or persisting provides the necessary foundation for effective arms control. This is a lesson borne out in the history of U.S.-Russia arms control, including the INF Treaty. The decision to pursue a modern sea-launched cruise missile capability is a Treaty-compliant response to Russia's violation of this Treaty and—it is hoped—will provide an incentive to Moscow to return to compliance or agree to negotiate limits on nonstrategic nuclear weapons that could enhance allied security.

Likewise, minimizing the number of nuclear weapon states and limiting the spread of expertise and technology that enable nuclear proliferation remain foundations of American policy. We understand our unique leadership role in nonproliferation and nuclear security, and our commitment to these goals—and to exercising active leadership in pursuing them—is undiminished. We remain focused on a pragmatic approach to strengthening the NPT and the and other elements of the global nonproliferation regime and creating conditions within the NPT framework for further progress in disarmament, consistent with our obligations under Article VI of the Treaty.

At the same time, despite the importance of these goals, we no longer believe they can be effectively advanced by unilaterally reducing or limiting the capabilities available to ensure deterrence. Today that path carries unacceptable risk. Nonproliferation faces acute challenges, to be sure, but can and will be pursued even as we take the steps necessary to strengthen nuclear deterrence.

CONCLUSION

According to Secretary Mattis, "nuclear weapons have and will continue to play a critical role in deterring nuclear attack and in preventing large-scale conventional warfare between nuclear-armed states for the foreseeable future."

In an increasingly complex and threatening security environment, DOD must sustain the capabilities needed to deter and defend against attacks on our homeland, as well as those aimed at U.S. Forces deployed abroad, our allies and partners. This requires making the investments needed to address the on-going erosion of our nuclear capabilities. Along with our allies and partners, we must ensure that we have the capabilities needed, now and in the future, to protect our people and the freedoms we cherish, and are able to engage potential adversaries diplomatically from a position of strength. This is a top priority of the Department of Defense.

While nuclear deterrence remains a bedrock of our security, Secretary Mattis has also observed that "the U.S. approach to nuclear deterrence embraces two co-equal principles: First, ensuring a safe, secure and effective nuclear deterrent; and second, working wherever possible for nuclear nonproliferation and arms control, whenever it advances stability and security for us and our allies. Nuclear deterrence and efforts to foreclose proliferation and reduce the number of nuclear weapons are not mutually exclusive."

To achieve these goals, I urge you to support the important capabilities contained in the President's fiscal year 2019 budget request.

Thank you again for the opportunity to testify. I look forward to your questions.

Senator FISCHER. Thank you.

General Rand?

STATEMENT OF GENERAL ROBIN RAND, USAF, COMMANDER, AIR FORCE GLOBAL STRIKE COMMAND

General RAND. Good afternoon, Chairman Fischer and Ranking Member Donnelly. Thank you for allowing me to appear before you today, and thank you very much for your kind remarks.

As I conclude my third year in command of Air Force Global Strike Command, I have four fundamental focus areas.

First, the fight tonight, the fight in 2030, the professional development of our airmen, and the care and feeding of our families. Today I will highlight two of these areas in my opening comments.

In the fight tonight, let me say the strength of Global Air Force Strike Command is in our 34,000 airmen and their remarkable families. Representing them today is Command Chief Master Sergeant Tommy Mazzone, a highly distinguished combat veteran and

the senior ranking non-commissioned officer in our command. He is also my best wingman. He and these airmen are nothing short of spectacular and deserve our Nation's gratitude for their service of providing global strike and strategic nuclear deterrence.

Right now, we have airmen deployed to the Intercontinental Ballistic Missile fields of Colorado, Nebraska, Wyoming, Montana, and North Dakota, where they provide a 24/7, 365-day umbrella of strategic nuclear deterrence and assurance for our Nation and our allies.

At the same time, we have striker airmen deployed in the Middle East in support of Central Command and Africa Command fighting violent extremists. We have airmen deterring our adversaries and assuring our partners in European Command and Pacific Command, and we have airmen supporting counter-narcotic operations in United States Southern Command, all of this while our bomber airmen remain postured to support the United States Strategic Command's nuclear operational plan.

At the direction of the commander of the United States Strategic Command, in September 2017, we reorganized to establish one line of authority for USSTRATCOM's air component under a single four-star commander. The reorganization established clear lines of authority, simplifying an outdated command structure for bomber and our missile forces. My position is now dual hatted as the Commander of Air Force's Strategic-Air Joint Force Air Component Commander and the Commander of Air Force Global Strike Command.

A major part of this reorganization was to activate the Joint Global Strike Operations Center, or J–GSOC, headquartered at Barksdale Air Force Base. The J–GSOC enables us to focus on the operational nuclear deterrence and global strike missions, while the headquarters of Air Force Global Strike Command focuses on the organize, train, and equip aspects of our mission.

Equally important as our ability to fight tonight is our ability to fight in 2030. Simply stated, modernization of our nuclear forces is at a critical juncture. The key to Air Force Global Strike Command's continued success will remain our ability to modernize, sustain, and recapitalize. To accomplish this we must have predictable, adequate, and flexible budgets in order to continue our readiness recovery while building a more capable and lethal force. The future, as great power competition reemerges as a major focus area, requires that Air Force Global Strike Command lead the way.

I am happy to report today that we're on a good path moving forward, and I look forward to answering any of your questions about our modernization and sustainment plans related to our mission.

Again, Madam Chairwoman and subcommittee members, Ranking Member Donnelly, I want to thank you for your dedication to our great Nation and the opportunity to appear before the committee today to highlight the missions and successes of the striker airmen and Global Air Strike. Thank you.

[The prepared statement of General Rand follows:]

PREPARED STATEMENT BY GENERAL ROBIN RAND

INTRODUCTION

Chairwoman Fischer, Ranking Member Donnelly and distinguished members of the committee, thank you for allowing me to come before you and represent 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

Air Force Global Strike Command is a warfighting command responsible for two legs of our Nation's nuclear triad and the Nation's nuclear command, control, and communications (NC3) 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, assure our allies, and hedge against an uncertain future. 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 lethal, safe, and secure. 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. Sustaining and progressing these efforts require predictable, sufficient, and flexible budgets. Reinforced in the 2018 Nuclear Posture Review, the nuclear deterrent is at a crossroads, and there is no higher priority for national defense. We must concurrently modernize the nuclear triad and the infrastructure that enables its effectiveness, and we require budget stability to accomplish these efforts.

In 2017, AFGSC significantly reorganized at the direction of the Commander, United States Strategic Command (CDRUSSTRATCOM), the first step in a larger USSTRATCOM restructuring. Under the previous construct, responsibilities for the air, space, and naval strategic missions were spread amongst several lines of authority. The reorganization solved two issues.

First, it cleaned up an outdated and confusing command structure for bomber and intercontinental ballistic missile (ICBM) forces under USSTRATCOM. Second, it allowed AFGSC to reshape the command and stand up a full time air component to USSTRATCOM. Our Nation relies on the strategic deterrence AFGSC provides every day. In order to perform this high priority mission, AFGSC needed an organizational structure that allows a portion of the command to focus on supporting day-to-day deterrence, while the rest of the command focuses on OT&E commitments. On 29 September 2017, AFGSC stood up Air Forces Strategic–Air (AFSTRAT–Air) as the full time air component to USSTRATCOM. This gives CDRUSSTRATCOM a single four-star general responsible for USSTRATCOM's air missions.

The Joint-Global Strike Operations Center (J–GSOC) was created to handle the day-to-day responsibilities of the strategic deterrence mission for USSTRATCOM's air component. The J–GSOC consists of the Joint Air Operations Center (JAOC) Joint Nuclear Operations Center (JNOC). The JAOC, already in existence, handles the conventional portion of the command's mission. The two nuclear task forces were combined into the JNOC, and focuses on the nuclear portion of the command's mission. Several additional mission teams were also aligned under the J–GSOC. The National Airborne Operations Center (NAOC), combined with AFGSC's existing responsibility for the E–4B, allows AFSTRAT, through USSTRATCOM, to better organize, train, equip, and present the NAOC mission to support the President and Secretary of Defense. The Standoff Munitions Application Center (SMAC) was stood up to provide expertise in planning and targeting of Air Force standoff weapons. The Cruise Missile Support Activity Atlantic (CMSALANT) and Pacific (CMSAPAC) were also aligned under the J–GSOC, and combined with SMAC, give the J–GSOC the ability to plan and target any standoff weapon in support of any combatant commander.

In addition to standing up the J–GSOC, CDRUSSTRATCOM also designated the AFGSC Commander as the Joint Force Air Component Commander (JFACC). The dual-hatted Commander, AFSTRAT–Air/JFACC has the ability to monitor, control, and direct all the air assets assigned or attached to USSTRATCOM anywhere in the world. These include the Air Force bomber, tanker, intelligence, surveillance, and reconnaissance, and ICBM forces as well as the USSTRATCOM Airborne Command Post (ABNCP) and Take Charge and Move Out (TACAMO) missions. The JFACC also supplies a common operating picture to CDRUSSTRATCOM that provides status and locations of all air assets.

These warfighting authorities were immediately tested during USSTRATCOM's Global Thunder exercise, and performed well beyond expectations. We have already achieved initial operating capability and are on track to achieve full operational capability by July 1, 2018. As emphasized in the 2017 National Defense Strategy (NDS), the global security environment is now more complex and volatile than experienced in recent memory, and inter-state strategic competition is now the primary concern in U.S. national security. The Air Force fiscal year 2019 budget prioritizes a more lethal and ready force, strengthening alliances and partnerships, and delivering greater performance. AFGSC's bomber, ICBM forces, and NC3 systems support both the NDS strategy and Air Force priorities by deterring potential adversaries, assuring our allies and partners, and guaranteeing the security of our national interests through cost-effective modernization. If deterrence should fail, AFGSC stands ready to defeat our adversaries through the persistent employment of lethal 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, the Kirtland Underground Munitions Maintenance and Storage Complex at Kirtland Air Force Base, New Mexico, and a ground combat training squadron at Camp Guernsey, Wyoming. The 450 dispersed and hardened Launch Facilities (LFs), are controlled, maintained, defended, and supported by AFGSC airmen every single day, providing the bulk of our day-to-day nuclear alert force, and doing so with precision and professionalism. Our ICBM experts, the silent warriors, are deployed in place, and preserve strategic stability by providing the nation a credible and responsive deterrent in a contested environment and presenting 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 MMIII ICBM and its command, control, and communications systems and support equipment. To modernize our existing fleet of large missile maintenance vehicles, we continue moving forward on the $123 million Transporter Erector Program (TERP) and the $201 million Payload Transporter Replacement (PTR). We currently expect PTR to begin production in fiscal year 2019.

The ICBM Launch Control Centers (LCC) will be equipped with modernized communications systems to improve and replace aging and obsolete systems. The LCC Block Upgrade, expected to begin full deployment in 2019, is a $96 million modification effort that replaces multiple LCC components to include modern data storage and higher fidelity voice communications capabilities. A significant security upgrade to the remote visual assessment capability at our LFs will increase situational awareness and security. This $51.6 million program is expected to begin deployment in fiscal year 2019.

In fiscal year 2018 we are scheduled to conduct three operational MMIII flight tests and two simulated electronic launch tests that will demonstrate the operational credibility of the nuclear deterrent force and the AF"s commitment to sustaining that capability. We conducted four MMIII flight tests and two simulated electronic launch tests in fiscal year 2017.

In an effort to vastly improve the nuclear capability of our ICBM force, the ICBM Programmed Depot Maintenance program began in fiscal year 2016. The program places operational LFs and LCCs on an 8-year depot-level maintenance cycle. It greatly increases the effectiveness and lethality of our ICBMs by ensuring their sustainment is done in an engineering-based, systematic way. Successful prototyping of the program was accomplished in fiscal year 2016, with 26 LFs and LCCs undergoing the maintenance. Thirty nine LFs and LCCs were completed in fiscal year 2017, and 50 are planned in fiscal year 2018. This program is key to ensure MMIII viability through the transition to Ground Based Strategic Deterrent (GBSD).

Our effort to remove 50 ICBM boosters from their LFs as part of our effort to meet New Strategic Arms Reduction Treaty (START) limits is complete. The selected LFs are spread across all three ICBM wings and will remain fully operational and capable of receiving boosters, if needed. The final booster was removed in early June 2017, a full nine months ahead of the treaty-mandated suspense of February 2018.

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 MMIII, suffers from age-out, asset depletion, and numerous performance shortfalls. Simply put, it will not meet critical mission performance or force requirements by 2030.

To meet these requirements, we're successfully moving forward on developing the GBSD. OSD/AT&L approved the GBSD Acquisition Strategy in July 2016, Milestone A was achieved on 23 August 2016; on 21 August 2017, technology maturation and risk reduction contracts were awarded, 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. GBSD is fully funded at $8.5 billion for fiscal year 2019 to 2023.

We remain engaged with our Navy partners and have identified promising areas for intelligent commonality between GBSD systems and future Navy weapons. Additionally, we are collaborating with the National Nuclear Security Administration (NNSA) to develop a W78 warhead replacement program starting in 2019. The replacement warhead will use a Mk21 aeroshell and will deploy on GBSD after fiscal year 2030; the Navy will study the feasibility of using the same nuclear explosive package with their flight vehicle. Due to MMIII system age-out, attrition, and commitment requirements, the first priority is to modernize the necessary facilities, replace the missile, and modernize command and control (C2) systems.

UH–1N

AFGSC is the lead command for the Air Force's Vietnam-era fleet of 63 UH–1N helicopters. The majority of these aircraft support several critical missions: security of our ICBM fields, transport missions in the National Capitol Region and U.S. Pacific Command areas of responsibility, and critical Continuity of Operations. 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. As an example, Malmstrom AFB's UH–1N Airmen have been credited with over 400 saves in their history.

UH–1N Replacement

In order to continue supporting these critical national missions and fully comply with Department of Defense (DOD) and United States Strategic Command (USSTRATCOM) requirements, the Air Force has committed $2.3 billion in fiscal year 2019 to 2023 toward 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. Vendor proposals were received in September 2017, and contract award is anticipated summer of 2018.

Airborne Launch Control System

The Airborne Launch Control System (ALCS) is USSTRATCOM's only alternate and survivable launch control system for the MMIII. The ALCS consists of an airborne component onboard 16 Navy E–6Bs and a ground component housed at all 450 MMIII launch facilities.

The current ALCS was fielded in 1987 and requires 100 percent recapitalization of existing architecture and infrastructure as well as full replacement of specific portions of the system. The ALCS Replacement program will replace and modernize the current system through 2035 and will replace both airborne and ground components enabling integration of GBSD command and control requirements through smart, modular design. ALCS–R is funded to $657.3 million in the Fiscal Year 2019 Presidential Budget.

Bomber Forces

Eighth Air Force (8 AF) 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, and deployment.

Since 1991, the Air Force has conducted continuous combat operations resulting in a growing toll on airmen, their readiness, and equipment. Bombers have supported operations through continuous rotations in United States Central Command (CENTCOM), United States Pacific Command (PACOM), United States Africa Command (AFRICOM), United States European Command (EUCOM), and United States

Southern Command (SOUTHCOM) areas of responsibility (AORs). Bomber contributions to our national security in the Cold War, Vietnam, and operations Desert Storm, Allied Force, Iraqi Freedom, Enduring Freedom, and today's Inherent Resolve and Freedom Sentinel are well documented.

At the end of Desert Storm in 1991, the Air Force had 290 total force bombers, 17 bomb wings, and 22 bomb squadrons. Today the number has dropped to 157 bombers, 5 bomb wings, and 9 bomb squadrons. That is a 46 percent decrease in our bomber force, a 70 percent decrease in bomb wings, and a 60 percent decrease in bomb squadrons. The demand signal for bombers has continued to increase in the last two decades, while long range airpower assets have decreased by 46 percent during the same timeframe. To assure our allies and partners, and to increase regional stability, AFGSC provides bomber forces arrayed across the globe, providing flexible, responsive options to combatant commanders. The deployments in support of the CENTCOM AOR and the Continuous Bomber Presence in the PACOM AOR send a strong signal to our allies of our commitment to our treaty obligations and their regional concerns. Additionally, AFGSC provides bomber forces to support SOUTHCOM's Joint-Interagency Task Force-South, EUCOM, and AFRICOM through the Joint Staff's Global Force Management process and Bomber Assurance and Deterrence-ordered deployments and missions. These opportunities enhance our support to our allies and display our resolve to potential adversaries. The core of AFGSC assurance and deterrence is our unwavering commitment to USSTRATCOM and our nuclear mission. AFGSC must balance global force posturing with our nuclear mission, while not jeopardizing readiness and fleet health. Arraying bomber forces globally, to increase strategic flexibility and response to a changing global security environment, while doing no harm to our nuclear mission, will further enhance our assurance to allies and partners and posture our forces in such a manner where our adversaries take notice.

B–1

The B–1 is a highly versatile, conventional-only multi-mission weapon system that carries a large payload of both guided and unguided weapons, which it can rapidly deliver in support of combatant commanders around the globe. Multiple wartime employments, high operations tempo, and harsh environment exposure have proven the aircraft's combat effectiveness, but have impacted aircraft availability.

The B–1 will continue to be in service for two more decades and avionics and weapon upgrades are critical for it to remain a viable combatant commander tool. The Integrated Battle Station/Sustainment Block-16 ($152 million fiscal 2019–23) includes an upgraded Central Integrated Test System, Fully Integrated Data Link, Vertical Situation Display, and flight simulator upgrades. These are essential capabilities and the will provide the aircrew with a much more flexible, integrated cockpit.

The stand-off weapons currently employed by the B–1 include the Joint Air-to-Surface Standoff Missile (JASSM), the Joint Air-to-Surface Standoff Missile-Extended Range (JASSM–ER), and very soon the Long Range Anti-Ship Missile (LRASM). This unmatched precision strike capability has guaranteed a critical role for the B–1 in assuring our allies and deterring potential adversaries now and into the future.

B–52

The B–52 may be the most universally recognized symbol of American airpower, it is able to deliver the widest variety of nuclear and conventional weapons, and boasts the best aircraft availability and mission capable rates of all three bomber platforms.

The B–52 will remain a key element of our bomber force until the 2050s and it is paramount that we continue to invest resources into this aircraft. B–52s are still using 1960s radar technology with the last major radar upgrade done in the early 1980s. 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 $733 million fiscal year 2019 to 2023 B–52 Radar Modernization Program now has an approved acquisition strategy, a Joint Staff-validated Capability Development Document, and has entered execution in the pre-Milestone B phase. Furthermore, B–52 training simulators are lagging behind operational aircraft capabilities. They require integration of various programs such as Combat Network Communications Technology (CONECT), internal weapons bay upgrade, data link capabilities, air refueling, and information technology refresh. Supporting the revitalization of these critical training tools will create high fidelity training environments and increase the readiness of B–52 crews in support of nuclear and conventional missions.

Additionally, the 1960-era TF–33 engines currently on the B–52 are operating on parts salvaged from aircraft no longer in the inventory. The supply of these parts, no longer made by industry, will be exhausted and leave the engines unsustainable by 2030. The Air Force is now funding efforts ($1.6 billion fiscal years 2019 to 2023) to integrate and deploy replacement B–52 engines, which will save fuel, extend the aircraft's range, and improve reliability and sustainment.

Today, we have 37 B–52s converted to the CONECT configuration. This modification moves the B–52 into the digital age for the first time, providing an on-board local area network, allowing the aircrew to share a common battlespace picture. This modification is installed on every aircraft going through regular program depot maintenance cycle. The Internal Weapons Bay Upgrade increases B–52 smart weapons capacity by 67 percent. This capability reached its initial operational capability milestone in May 2016 and added Joint Air-to-Surface Standoff Missile (JASSM) and Joint Air-to-Surface Standoff Missile-Extended Range (JASSM–ER) capability in October 2017. Communications remain the cornerstone of our long-range strike capability. The ability to launch bombers and retask and retarget them while enroute to the battlespace is a powerful force multiplier. We will add 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 line-of-site Link-16.

Finally, we have converted 29 operational and 12 stored B–52 aircraft to conventional-only configurations. These conversions were undertaken as a part of New START obligations, and were completed in January 2017, a full year ahead of the treaty-mandated suspense of February 2018.

B–2

For nearly 25 years, B–2s have provided the Nation with an assured penetrating bomber capability. The B–2's ability to penetrate enemy defenses, holding targets at risk anywhere on the globe, with a variety of nuclear and conventional weapons, has provided deterrence against our enemies and stability for our allies. The B–2's conventional accomplishments are numerous and incontrovertible; the bomber provided precision attacks during the Kosovo and Iraq Wars, strikes on the Taliban and al Qaeda in Afghanistan, and on forces in Libya.

B–2 modernization efforts are addressing a nuclear command and control need by bringing a survivable very low frequency communication capability to the aircraft. Additionally, with the proliferation of anti-access/area denial 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 currently programmed for $144 million in RTD&E and 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 of sustaining and modernizing the B–2's small fleet, and an ever-decreasing technological advantage, are some of the drivers for the planned minimum B–21 requirements.

B–21

Technology gaps between the U.S. and potential adversaries are closing. The B–21 Raider will support the nuclear triad by providing an advanced and flexible deterrent capability and 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 capabilities, large and mixed payloads, and survivability. From the outset, the B–21 has been designed to have an open architecture, which enables it to integrate new technology and respond to future threats. The B–21 program is a national security imperative that will extend American air dominance and lethality against next generation capabilities and advanced air defense environments.

The B–21 is fully funded in the fiscal year 2019 budget submission, and initial capability is projected for the mid-2020s. Extensive campaign and mission level analysis will determine the minimum number of B–21s required to meet combatant commander needs in the face of closing technology gaps and increasing threat capabilities.

As the B–21 development progresses, the Air Force is conducting the strategic basing process. While B–21 fielding will include new construction and facility renovation, current bomber bases have infrastructure for operations, maintenance, munitions storage, security, and training. Additionally, base operating support and off-

base community support are well-established at current bomber bases. While conducting B–21 bed down, our primary focus will be providing safe, secure, and lethal 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 (LEP). While the ALCM remains effective today, we must replace it due to its aging subsystems, the shrinking stockpile of operational missiles (546), and advances in enemy defenses. We plan to invest $380 million in fiscal year 2019 to 2023 to continue SLEPs and testing efforts that include critical telemetry, encryption, and flight termination components until the Long Range Stand-Off (LRSO) missile 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. Its only employment platform is the B–52 and unlike the ALCM, CALCM has not received any LEPs to maintain reliability or viability against enemy defenses. NDAA language prevents 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 and B–1, with B–2 capability projected for fiscal year 2019. 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.

Long Range Stand-Off Missile

The Air Force dedicated $2.6 billion in fiscal year 2019 to 2023 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-range, and survivable weapon system and is absolutely an essential element of the nuclear triad. It will be flexible and 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 members, and negatively impacts our ability to execute the mission. Additionally, AFGSC is synchronizing efforts with NNSA to fully integrate the W80–4 nuclear 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 nonnuclear 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. The Air Force awarded contracts for technology maturation and risk reduction in August 2017.

B61

The B61 family of gravity nuclear weapons supports the airborne leg of the triad and is the primary weapon supporting our NATO allies under extended deterrence. The B61 is currently undergoing a LEP that results in a smaller stockpile, reduced special nuclear material in the inventory, modernized safety and security features, and reduced lifecycle costs by consolidating four weapon versions into one version, the B61–12. The B61–12 includes the addition of a digital weapons interface and a guided tail kit assembly. AFGSC is the lead command for the $419 million fiscal year 2019–23 B61–12 Tail Kit Assembly program, a DOD-developed system providing reduced maintenance, reduced cost and increased sustainability. The B61–12 Tail Kit Assembly program is in Engineering and Manufacturing Development Phase 2 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, PACOM, and the Air Force Life Cycle Management Center Program Office are currently validating a requirement to expand the weapon's operational capabilities.

SECURITY & INFRASTRUCTURE

Nuclear security is a key function of the command's mission, and a major AFGSC security initiative continues to be new weapon storage facilities. 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 mitigates security, design, and safety deficiencies and improves our operational lethality.

One of our growing concerns is the impact that degraded and unpredictable infrastructure funding is having on our missions, our airmen, and their families. Our bases are power projection platforms, and should be viewed as 3–D weapon systems. This is particularly true for our ICBM and B–2 bomber bases, which stand in continuous readiness to initiate global strike missions directly from these locations. For years, the Air Force has been forced to make deliberate decisions to take risk in infrastructure funding, in order to apply scarce dollars toward higher readiness and modernization priorities. The cumulative effect has been a steady erosion of our facilities and core infrastructure, and a huge growth in costs to address our exponentially growing repair and replacement backlogs. As we bring new systems online such as Weapon Storage Facilities, the B–21 Raider, and GBSD, some of our installation infrastructure will receive much needed recapitalization. However, it will be several years before those systems are in place, and will not address much of the infrastructure where our airmen work and live. We are seeing a growing risk in facilities and infrastructure reliability, higher overall costs due to accelerated deterioration, and increasing potential for unexpected catastrophic, mission-impacting failure. Our innovative airmen have, and will continue to, focus limited resources on "mission critical, worst first" facilities and infrastructure while accepting risk in the recapitalization of facilities with less-direct mission impact such as community and base support. There is without question a link between facility condition and quality of life, as well as quality of service. Without your support of the fiscal year 2019 President's request for MILCON and facility sustainment, restoration and modernization funding, we will not only continue to increase our risk of mission interruption or degradation, but will also be unable to adequately address the quality of life of our airmen and their families. Providing a predictable, stable budget will not only enhance our lethality, but will go far in providing our airmen with working and living environments that directly enhance their readiness.

NUCLEAR COMMAND, CONTROL, AND COMMUNICATIONS

Air Force nuclear command, control and communications (NC3) systems connect the President to senior advisors and the nuclear forces. Receiving presidential orders and converting them into actionable directives are critical to having a strong strategic deterrent. AFGSC is the Air Force's lead command for National Leadership Command Capabilities (NLCC)/NC3 which establishes a single focal point for the NC3 weapon system.

AFGSC is aggressively working to maintain and sustain the NC3 weapon system. 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. In a major organizational effort, AFGSC stood up the USAF NC3 Center in April 2017. The NC3 Center oversees interoperability, standardization, and configuration control of the Air Force's NC3 weapon system, and will plan and program for NC3 investment, sustainment, and operations.

In its first year, the NC3 Center has taken great strides in cross-MAJCOM governance to ensure strong advocacy as NC3 programs compete for resources within the Air Force Corporate process. An outstanding example of the Air Force's increased emphasis on NC3 includes the $275 million allocated for E–4B modernization programs, which is in the fiscal year 2019 Presidential budget for the fiscal year 2019 to 2023 FYDP. Additionally, the E–4B replacement program, the Survivable Airborne Operations Center is programmed to receive $182 million to begin the effort to replace the aircraft itself. For nuclear planning and execution analysis,

$72.6 million is allocated to complete the Mission Planning Application System Increment 5 program at USSTRATCOM. The Global Aircrew Strategic Network Terminal Increment 1 program for Advanced Extremely High Frequency (AEHF) capability at nuclear-tasked command posts receives $246 million to complete terminal procurement. To ensure connectivity with our B–52 fleet, $132.6 million is programed to integrate the Family of Advanced Beyond Line of Sight Terminals onto the aircraft. The B–52 will also integrate a new very low frequency receiver ($175.6 million), and we have allocated $73.9 million to upgrade our oldest system, the Strategic Automated Command Control System. To ensure connectivity with our ICBMs via USSTRATCOM's only alternate and survivable launch control system for the MMIII, the Airborne Launch Control System-Replacement has been funded $83 million in fiscal year 2019. Collectively, these NC3 efforts add $1.20 billion over the fiscal year 2019–23 FYDP to assure the President connectivity to the Nation's nuclear forces.

In addition to modernization efforts, the NC3 Center is standardizing the training of airmen who operate and maintain NC3 equipment. The Center built new courseware and developed "hands-on" simulators for airmen coming out of technical school to gain experience before arriving at operational bases. For more experienced personnel, the Center also secured distance learning systems to grant engineering graduate degrees through universities such as Harvard, Stanford, and Portland State University. Additionally, the Center has streamlined the reporting of communication system outages so combatant commanders receive real-time status and impact updates of temporary NC3 capability degradations and worked with Defense Logistics Agency to improve processes to provide a reliable, secure supply chain.

ONGOING INITIATIVES

Since 2014, the Air Force has applied deliberate and sustained focus to address shortfalls. AFGSC's ongoing efforts—spanning the full-range of personnel, management, oversight, mission performance, training, testing, and investment—continue to produce tangible and lasting improvements. As this committee is well aware, the Air Force and AFGSC have undertaken monumental shifts to build a more lethal force.

AFGSC initiated an effort to invigorate Security Forces (SF), specifically in the critical function of nuclear security. This initiative focuses on increasing SF lethality and readiness by enhancing leadership, proficiency, and effectiveness of personnel guarding our strategic deterrence capabilities. Changes have included increasing manning, especially in supervisory positions, increasing training cadre, investing in SF leadership through focused professional development, and implementing a Missile Security Operating Concept. This squadron deployment model, implemented across all three ICBM wings, optimizes core skill presentation in the field, keeps leadership with their airmen, and provides stable, work-rest-train cycles. While the command has achieved early success with this program, we still have improvements to make in modernizing equipment and infrastructure, and decreasing position vacancies. Finally, Secretary Wilson directed a follow-on review, led by AFGSC, which is expected to result in external recommendations for cross-cutting improvements to Air Force Security Forces that will enhance the nuclear mission by providing world-class security forces with world-class equipment.

In 2017, we stood up an Independent Strategic Assessment Group (ISAG), comprised of former DOD leaders. The ISAG conducted a deep dive into numerous key areas, including current management structure and practices of the Nuclear Enterprise, and how AFGSC can field a more lethal force. The assessments produced nearly 50 action items the command is tackling so we can more effectively accomplish our deterrence and global strike missions. Going forward into this year, I've asked the group to look into additional key areas and provide recommendations. We will continue using this independent look to help shape innovation, change, and improvement throughout the command.

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 Air Force Core Values and reinforced by our rich heritage. We exist to serve the Nation by providing strategic deterrence and global strike; we are ready to fight tonight, and are planning for the fight in 2030. The airmen in this command make this possible and I have charged my staff to emphasize professional development and provide more opportunities for every rank. I truly believe that while we recruit airmen, we retain families, which is why one of my initiatives is a renewed focus on quality of life. I declared 2017 the Year of the Family in AFGSC. We stood up the Family and Air-

men Support Team to identify ways we can improve where our airmen live, learn, and receive medical care. We will continue to build upon this and other initiatives throughout 2018.

CONCLUSION

Although we account for less than one percent of the overall Federal budget, AFGSC forces represent two-thirds of the Nation's nuclear triad and oversee approximately 75 percent of the Nation's NC3 systems. This is especially profound when considering these forces deliver U.S. national security 24 hours a day, 365 days a year, 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; however, as stated in the NDS, we cannot expect success fighting tomorrow's conflicts with yesterday's weapons.

Modernization is critical. Great power competition has reemerged. 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 our adversaries and be prepared to fight with modern and reliable forces. Any American weakness emboldens competitors to subvert the rules-based international order and challenge the alliance and partnership network that underpins it. To continue to do what the Nation requires of us, we require a stable budget and we are on a good path moving forward; the American people and our allies are counting on continued congressional action to fund our nuclear enterprise modernization efforts.

Senator FISCHER. Thank you, General.

Admiral Benedict?

STATEMENT OF VICE ADMIRAL TERRY J. BENEDICT, USN, DIRECTOR, STRATEGIC SYSTEMS PROGRAMS

Admiral BENEDICT. Yes, ma'am. Madam Chairman, Ranking Member Donnelly, thank you for the opportunity to be here today, and thank you for your support of the Navy's deterrence mission and for your very kind words to open.

It's been my greatest privilege as the Director to represent the men and women of SSP [Strategic Systems Programs] for the last eight years. My goal as the Director has been to ensure that they are properly positioned to execute the mission with the same level of success today and tomorrow as they have done since our program's inception in 1955.

SSP is currently extending the Trident II D–5 strategic weapon system to match the *Ohio*-class service life and to serve as the initial weapon system on the *Columbia*-class. I'll summarize our efforts by saying that all of our life extension programs remain on track and on budget. Our life extension efforts will ensure an effective and credible sea-based strategic deterrent on both the *Ohio* and the *Columbia*-class until the 2040s.

The Navy is also taking steps to ensure a credible weapons system is available beyond 2040. In fact, the last Nuclear Posture Review directs the Navy to "begin studies in 2020 to define a cost-effective, credible, and effective sea-launched ballistic missile that we can deploy through the life of the *Columbia* SSBN [Subsurface Ballistic Missile Nuclear] through the 2080s." We will execute that direction.

I look forward to your questions. Thank you.

[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 (SLBM) is essential to our ability to deter major warfare with adversaries and assure our allies. Each leg provides unique attributes and provides an effective hedge. The 2018 Nuclear Posture Review reaffirms that the nuclear triad is the bedrock of our ability to deter aggression, assure our allies, and hedge against an uncertain future. It also reaffirms the need to recapitalize each component of the triad.

The Navy provides the most survivable leg of the triad with our *Ohio*-class ballistic missile submarines (SSBNs) and the Trident II (D5) strategic weapon system (SWS) they carry. SLBMs are responsible for a significant majority of the Nation's operationally deployed nuclear warheads. The Chief of Naval Operations (CNO) has made clear the priority the Navy places on the maintenance and modernization of the undersea leg of the triad, saying it "is foundational to our survival as a Nation."

SSP's mission is to design, develop, produce, support, and ensure the safety and security of 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.

Our fiscal year (FY) 2019 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; Trident II (D5) SWS Long-Term Sustainment; the *Columbia*-class Program; the Solid Rocket Motor Industrial Base; and my Navy Nuclear Deterrence Mission Oversight responsibility.

The men and women of SSP and their predecessors have provided unwavering and single mission-focused support to the sea-based leg of the triad for over six decades. As an organization, SSP is facing a bow wave of critical work, as most recently evidenced by the 2018 Nuclear Posture Review. The organization must be prepared to sustain and modernize a credible and effective strategic weapon system to support our ballistic missile submarines and our strategic deterrent mission until the 2080s. It has been my highest honor to represent the men and women of SSP for the past eight years, and my goal, as the Director, is to ensure they are properly positioned to execute the mission with the same level of success today and tomorrow as they have done since our program's inception in 1955.

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 Master at Arms Sailors provide an effective and integrated elite security force at our two Strategic Weapons Facilities within their area of operations to include the Limited Area, Convoy Route, and the 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 ballistic missile 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.

We thank the Congress for the authorities provided in the Fiscal Year 2017 National Defense Authorization Act allowing the Services to use technological means to counter unmanned aerial systems (UAS) at our installations. This authority has enabled us to deploy systems that give our security forces a greater ability to identify, track, and defeat unauthorized small UAS.

The Navy and SSP maintain a culture of self-assessment in order to ensure safety and security. This is accomplished through formal biennial self-assessments, periodic technical evaluations, formal inspections, and continuous on-site monitoring and reporting at the Strategic Weapons Facilities and on submarines. 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 Trident II (D5) SWS has been deployed on the *Ohio*-class ballistic missile submarines for nearly three decades and is planned to be deployed 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 SWS 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 life extension of missile and guidance flight hardware components is designed to meet the same form, fit, and function of the original system, maintain 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 2017, the Navy deployed 24 life-extended missiles to the Fleet and remains on track to complete deployment by fiscal year 2024. Later this year, we will begin the Commander Evaluation Test (CET) program on life-extended missiles to measure the performance and capability of the system against the demonstrated performance.

Another major initiative to ensure the continued sustainment of our SWS is the SSP Shipboard Systems 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 refreshes shipboard electronics hardware and upgrades software, 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 U.S. Strategic Command (STRATCOM) requirements. Twelve installations were completed in 2017; and two have been completed so far this year with an additional twelve planned.

The Navy also works in partnership with the Department of Energy's National Nuclear Security Administration (NNSA) 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. Deliveries of life-extended W76 warheads to the Navy are over 85 percent complete and on track to finish by the end of fiscal year 2019. The W88 major alteration program remains on track to support a first production unit in calendar year 2019 with production scheduled to complete in fiscal year 2024.

In accordance with the Nuclear Posture Review, the Navy's fiscal year 2019 budget request supports two near-term additional efforts. The budget request supports investigating the feasibility of fielding the nuclear explosive package from the Air Force's W78 warhead replacement in a Navy reentry body. It also includes funding to begin efforts to modify a small number of SLBM warheads to provide a low-yield option. The Nuclear Posture Review directed that the modification to the existing warheads will not increase the overall number of deployed ballistic missile warheads. This near-term capability will bolster our deterrence posture by helping ensure that no adversary perceives an advantage through the use of limited nuclear escalation.

TRIDENT II (D5) SWS LONG-TERM SUSTAINMENT

The Trident II (D5) SWS continues to demonstrate itself as a credible deterrent and exceeds operational requirements established more than 30 years ago. Our life extension efforts will ensure an effective and credible SWS on both the *Ohio*-class and *Columbia*-class SSBNs until the 2040s. The Navy is also beginning an approach to maintain a credible and effective SWS beyond 2040, leveraging the work that is being done today to extend the life of the Trident II (D5) SWS as well as investigating opportunities to innovate, such as through the application of model-based engineering. In fact, the Nuclear Posture Review directs that the Navy "begin studies in 2020 to define a cost-effective, credible, and effective SLBM that we can deploy throughout the service life of the *Columbia* SSBN."

SSP has a history of more than 60 years of developing, producing, and supporting SWSs to support the undersea leg of the triad. We have optimized our SWS by applying 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. Life-extended missiles will be shared with the *Ohio*-class submarines until their retirement. Maintaining a common 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) with the United Kingdom. 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 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. The CMC will allow the life extended Trident II (D5) SWS to be deployed on the *Columbia* and the UK *Dreadnought*-class SSBNs. It will also support production of two new classes of SSBNs in both the U.S. and UK build yards. We have begun construction of missile tubes to support building the U.S. prototype Quad-pack module, the SWS—Ashore (SWS Ashore) integration test site, and the UK's first *Dreadnought* SSBN.

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 last year when test bay one, which will be used to test the Missile Service Unit first article, achieved initial operational capability. In 2019, test bay two will achieve initial operational capability for verifying and validating the SWS support systems for the *Columbia* and UK *Dreadnought* programs.

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. Last year, we started launching refurbished Trident II (D5) test shapes originally used in the 1980s. Ten evaluation launches were conducted in 2017 and we have conducted four of sixteen planned this year.

The *Ohio*-class SSBNs will begin decommissioning in the late 2020s and the *Columbia*-class must be ready to start patrols 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 SSBNs 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 operational requirements, but also the UK's ability to maintain a continuous at sea deterrent.

SOLID ROCKET MOTOR INDUSTRIAL BASE

The defense and aerospace industrial base—in particular the solid rocket motor industry and its sub-tier supplier base—remains an important priority. While the Navy is maintaining a continuous production capability of rocket motors, the demand from both National Aeronautics and Space Administration (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. Though future Air Force modernization will provide some much needed relief beginning in the mid-2020s, our Nation cannot 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. For example, we are concerned with ensured access to and affordability of certain critical solid rocket motor constituents, such as ammonium perchlorate. At SSP, we will continue to work with our industry partners, the Department of Defense, 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

In 2014, the CNO directed establishment of a centralized Navy oversight authority for nuclear force readiness. As the Director of SSP, I have been assigned 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 NNDM 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 of 2017, I submitted the second 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.

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. Sustaining the sea-based strategic deterrent capability is a vital national security requirement. 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. Thank you, Admiral.

As I noted in my opening statement, one of the basic premises of the NPR is that our nuclear forces must adapt to the changing threat landscape that we face. Some critics, including the Russian Government, have attacked us by denying that the security environment has changed, while others argue that the sheer power of the United States nuclear arsenal is somehow going to insulate us from any changes in a security environment.

Dr. Soofer, you touched on this in your opening statement when you note that "potential adversaries do not stand still," and consequently U.S. deterrence requirements cannot remain, as you put it, fixed.

We've heard plenty of testimony about the changing threat environment on this committee and on the full committee. I don't think that's in question. But I'd like to explore the notion that U.S. nuclear forces have no need to adapt to a different security environment.

So, Dr. Soofer, U.S. nuclear policy and planning has long emphasized the need for flexible adverse nuclear forces specifically to adjust to a changing threat landscape. Is that correct?

Dr. SOOFER. Yes, it is.

Senator FISCHER. I'm sure that you've seen these vague criticisms that the current U.S. nuclear posture is more than sufficient to deter any new threats. What is your reaction to statements like this? In your opinion, what would be the impact to strategic stability of overlooking the expansion of adversaries' arsenals, the increasing ability of adversaries to deny U.S. nuclear employment, and the violation of treaties, and concluding this warrants no change in U.S. nuclear posture?

Dr. SOOFER. Thank you, Madam Chair. As senior DOD leadership has testified, including General Hyten, today we have a strong nuclear deterrent, and there should be no question that we have the ability to deter current threats.

In the course of the Nuclear Posture Review, we concluded that, as I indicated, the threat doesn't stand still, and there's some disturbing trends out there that require a response.

One of the biggest problems that we faced was the growing disparity between Russia and the United States in a category of weapons called non-strategic nuclear weapons, sometimes referred to as tactical nuclear weapons. This has been a concern not only of ours but of previous administrations as well, and even during the New START ratification proceedings in 2010 there was a provision in the resolution ratification that directed the administration within one year to address this disparity, bring the Russians back to the negotiating table.

So we've been concerned about this for a long time, and we came to the conclusion that it wasn't just the numbers but it was the types of capabilities that they were deploying—depth charges, torpedoes, short-range ballistic missiles; air, land, and sea-launched cruise missiles. Why would you build so many different types of nuclear weapons? Both the United States and Russia reduced their tactical nuclear weapons at the end of the Cold War. We have a modest number that we are modernizing but certainly not expanding, but the Russians are expanding their capabilities.

So they have the capabilities, plus you've heard about their nuclear doctrine, their limited nuclear war doctrine. Some people would argue that maybe the Russians wouldn't do this in an actual scenario, but we have to assume that they would because they have the capability and they exercise the capability.

So you have the doctrine, you have the capabilities, you have what everybody agrees is a more belligerent Russia. So we add all that up, and we came to the conclusion that just maybe the Russians perceived an advantage with this new capability. After all, if they didn't think they needed them, they probably wouldn't build them given our strategic triad.

So we felt we had to do something in the near term and in the long term to address this problem. In the near term it's the modification of a modest number of submarine-launched ballistic missile warheads, just so the Russians understand that at that low level of low-yield capability, we have a response option, the president has a response option. It's for deterrence purposes, not for warfighting.

In the longer term, how do you address this growing disparity in non-strategic weapons? We've been trying to get the Russians to come back to the table to negotiate reductions, but they haven't been willing to come back. So by going forward with a sea-launched cruise missile capability, a capability that, by the way, is consistent with the INF Treaty, consistent with the New START Treaty, maybe this will give us some leverage to bring them back to the negotiating table.

If we don't do this, the problem may be that we get to a point where the Russians may perceive they have not only a military advantage over us, because the numbers are so disparate, but now your allies start to worry. They say, well, the Russians have two times or three times, ten times as many weapons as the United States does. Maybe in a crisis situation, they'd question our leader-

ship. So there's a real military and strategic problem associated, I think, with not addressing the growing threat.

I hope that answers the question.

Senator FISCHER. Yes. As we look at Russia and their doctrine of escalate to deescalate, and I think we've had numerous discussions on that in this subcommittee and in the full committee as a whole, there seems to be acceptance of that now and kind of almost a downplaying of it, and instead the focus I think is on—and I think it comes from the Russians in many areas. The focus is on we are so superior in our nuclear capabilities, the power that the United States has, then why would the United States need to change? They view it as a change in the posture that we're taking.

You mentioned so many points to that, but specifically how would you address the Russians saying that the United States has such superiority when it comes to our power that we have with our nuclear capabilities that there's no way they're going to do the escalate to deescalate?

Dr. SOOFER. First, the Russian claim in Putin's March 1st, speech, where he's claiming that he's doing this in reaction to what the United States is doing, of course that's nonsense because these capabilities, the Russian capabilities have been in development for decades. So it's clearly not a response to what the United States is doing. We are playing catch-up at this point. So I think that criticism on its face is just false.

So I'm not quite sure how to address it other than that. I would just go back to say that even Ash Carter, former Secretary of Defense, he noted that there has been no arms race. The only country that's been running this race has been the Russians over the last 10, 20 years.

Senator FISCHER. Thank you.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

Assistant Secretary Roberts, what is your assessment of the NNSA [National Nuclear Security Administration] efforts on modernization in general and the ability to produce up to 80 plutonium pits by 2030, as required by statute?

Secretary ROBERTS. Thank you, Senator, for the question. Given the future stockpile requirements, number one, I certainly support, as stated in the NPR, to produce 80 pits by 2030. Based on the work that we've done now, I think that we're in a good position to actually achieve that. We've recently completed a review. It was basically an engineering analysis, as well as a workforce analysis on the path that we've looked at, the various alternatives that have come out of those, both an analysis of alternatives review and this engineering analysis that was just recently completed.

The modernization aspects we've looked at that are in place at a production facility at Los Alamos, this is the one place where we still have existing and enduring production capabilities. In fact, Los Alamos has been the plutonium Center of Excellence for operations. They will have the capability to produce up to 30 pits per year. Now we have to look at how we get from 31 to 80.

So this engineering analysis was looking at the processes that are necessary to select the best location for future pit production requirements of 50-plus pits per year, and we're undergoing right

now a final assessment to make a recommendation to the Deputy Secretary of Energy. Hopefully that will be done very soon. We've looked at the various alternatives, and we've come up with a recommendation that will hopefully meet that requirement, and we'll do that before the 11th of May, which we're required to do by law, as you know.

Senator DONNELLY. Thank you.

Admiral Benedict, can you give us the status for fiscal year 2019 on the Navy role in the conventional prompt strike system?

Admiral BENEDICT. Yes, sir. To date, we have been operating under the Defense-wide account. We flew a very successful experiment late last year in the fall. As I have briefed, the results of that were classified, but it was a very successful experiment, met all our objectives. We have now been directed to do the second experiment along the lines of conventional prompt strike, as well as at the direction of OSD [Office of the Security of Defense] we are running a motor competition. The inputs from industry are in SSP. We are evaluating those, and I would suspect that we will make an award here very shortly.

Senator DONNELLY. Thank you.

Dr. Soofer, we haven't seen all the budget data for the low-yield submarine-launched ballistic missile. How much will it cost in fiscal year 2019 for the NNSA and for the DOD?

Dr. SOOFER. Thank you, Senator. I believe the request for Department of Defense is $23 million, and I think it will be $50 million to complete the project. Unfortunately, Senator, I don't have the numbers for NNSA. I'm going to say that they're going to be in a similar range, and those numbers will be provided to Congress by OMB [Office of Management and Budget] in a whole-of-government errata by the end of this month.

Senator DONNELLY. Okay. Thank you.

General Rand, my understanding is we dropped from the B–2 the ability to send and receive information with the new satellite system that can operate in a nuclear stress environment. Does that concern you?

General RAND. No, sir. I made that decision largely, and then coordinated it with my boss, General Hyten, at STRATCOM. The rationale, sir, is that the AEHF [Advanced Extremely High Frequency] that you referred to will not be fielded until 2026. It's our intention to sunset the B–2 in the early 2030s. The six years of utility to have us receive and transmit isn't worth the squeeze when that $1.3 billion that we save can be used for other more critical MC–3 capabilities across the enterprise.

I will tell you that what we did do is we have sped up the acquisition of what's called the common very low frequency receiver that we will start putting on the B–2 in fiscal year 2019.

Senator DONNELLY. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator Donnelly.

Senator Sullivan?

Senator SULLIVAN. Thank you, Madam Chair.

Gentlemen, thanks for being here.

Dr. Soofer, I wanted to thank you for your help previously on the Advancing America's Missile Defense Act. A number of us worked

on that last year and it became a full part of the NDAA [National Defense Authorization Act]; very strong bipartisan support, by the way. It started really significantly revamping our missile defense for our country when the threats are very significant.

As you know, in the previous NDAA there had been a demand for the completion of the Ballistic Missile Defense Review, and I'm sure all of you are hard at work. I had the opportunity to question Undersecretary Rood on that recently, and I was pressing him. Didn't get it, but I'd like to press you now to try to get the review sooner rather than later because, again, one of the things that I think was very positive in this last go-around was that it was very bipartisan. I'm working with a number of folks on the committee and some of the folks in the Pentagon. I'm looking at ways to make progress again on some of the missile defense issues.

It would be really important, as we're marking up the NDAA this year, to be informed by the review. Otherwise we essentially miss an entire year.

So you probably were ready for this question, but can we get a commitment from you to have that done, say, by within the next month? You know how this schedule works.

Dr. SOOFER. Yes.

Senator SULLIVAN. How about before we start marking up the NDAA in earnest?

Dr. SOOFER. Senator, we are now weeks away from getting this done. I think the draft is done. It's a coordination problem, and you know how difficult it is to get coordination.

Senator SULLIVAN. Correct, but you know how difficult it is to miss the window.

Dr. SOOFER. Yes, sir.

Senator SULLIVAN. Given your background, you know a lot about how the markup of that bill works. Do you think we'll have it in time to be informed as we mark up the next National Defense Authorization Act? It would be a missed opportunity is all I'm saying.

Dr. SOOFER. It would be, sir, and we will do our best to have it done and to you by the end of this month or early next month.

Senator SULLIVAN. Okay. Good. Well, we want to keep working with you and keep pressing you on that.

Let me ask, as we are looking at one of the things—we did a CODEL [Congressional Delegation], a number of us, up to Fort Greeley in Alaska where we're going to have a new missile defense field built. One of the challenges that we want to work with all of you on, Senator Inhofe and I, and I know the Chair and Ranking, I'm sure are very supportive of this as well, but when we were up there talking about how long it would take to actually fully operationalize a new field at Fort Greeley, which everybody agrees we need, the estimates were four, maybe five years—four, maybe five years. We won World War II in four to five years.

So we want to work with all of you to accelerate the deployment of these missiles that are supposed to protect the entire United States, and I think four to five years is unacceptable. I think everybody says it's unacceptable, but we need to look at ways to make sure that—the threat is here. The threat is here right now, today. The whole point of the bill was to advance our missile defense. Four to five years doesn't help anyone.

Do you care to comment on that, any of the members of the panel here? We need to do more, faster, and we can. We won a war in that amount of time. I think we can build a new missile field.

Dr. SOOFER. Senator, I agree. I've always wondered why it takes so long. The answer that usually comes back is the weather in Alaska, the construction——

Senator SULLIVAN. Well, trust me, we built the Alcan Highway in World War II, which was 1,100 miles, in eight months. We can do this stuff. We can do it. We're Americans, we can do it. So the weather is not a big deal in Alaska, trust me.

Dr. SOOFER. I think the other limiting factor may be development of the redesigned kill vehicle.

Senator SULLIVAN. We can get the silos built, and I'm not saying we have to get that done. How about just a commitment from all of you at all levels of the government to just accelerate this? Nobody wants this to be four to five years. Can I get that from everybody here in positions of authority?

Dr. SOOFER. Yes, sir.

Admiral BENEDICT. Yes, sir. Absolutely.

Senator SULLIVAN. One final question. As we are looking at the missile defense provisions in the NDAA, one issue that keeps coming up is the idea of space-based sensors uniformly to integrate our theater, Aegis, THAAD [Terminal High Altitude Area Defense], homeland. Would you all agree with that as a priority?

Dr. SOOFER. Absolutely.

Senator SULLIVAN. Okay. Thank you.

Senator FISCHER. Thank you, Senator Sullivan.

Senator Warren?

Senator WARREN. Thank you, Madam Chair.

Thank you to our witnesses for being here today.

So, the Administration's Nuclear Posture Review calls for a new low-yield submarine-launched ballistic missile. DOD has previously suggested that this could be accomplished quickly by modifying the W–76 warhead that goes into our existing submarine-launched Trident missile. The NNSA administrator recently came before our committee, and she testified that she didn't know how long it would take NNSA to modify the W–76 warhead, and she didn't know whether it could be done before the life extension production line closes at the end of the year.

So let me ask you this, Dr. SOOFER. Does DOD know how long it will take to modify the W–76 warhead?

Dr. SOOFER. When we considered this during the Nuclear Posture Review, and, since then, we came to the conclusion based on talking to people at NNSA that this could take 2 to 3 years at the most.

Senator WARREN. So you think 2 to 3. Does that mean it can't be done by the end of the life extension program?

Dr. SOOFER. I think it's important that it be done by the end of the life extension program.

Senator WARREN. So you think it will be within the end of the life extension program.

Dr. SOOFER. It should be.

Senator WARREN. Okay. All right. So, the NNSA administrator also testified that NNSA had not requested any funding to modify

the W–76 warhead, she didn't know if they would request a reprogramming or a supplemental request, so let me ask you about that one, Dr. Soofer. I understand that the DOD budget does include $22.6 million for the SLBM [submarine-launched ballistic missile]. Is the OMB request next month a reprogramming or a supplemental?

Dr. SOOFER. They call it, as a formal term, errata. It's a whole-of-government errata.

Senator WARREN. An errata?

Dr. SOOFER. An errata.

Senator WARREN. Okay.

Dr. SOOFER. It's a new term to me, as well. But it essentially will be a reallocation of funds, because I think they're thinking of trying to do that with existing funds, but I'm not sure. It's called an errata, a whole-of-government errata.

Senator WARREN. Okay, but it's a reallocation is what you're telling me, it's not new money. You're shaking your head, right? It's a reallocation. So what is the money going to be reallocated from?

Dr. SOOFER. That's a decision for NNSA and the Department of Energy to make, and I'm not privy to that.

Senator WARREN. So we don't know where it comes from.

Dr. SOOFER. You'll know when you see the budget request.

Senator WARREN. Okay. But right now, it's that somebody is actually willing to give up $23 million, right? Okay.

What is DOD using the $23 million for?

Admiral BENEDICT. So, ma'am, the $23 million in the Department of Defense is actually in my budget, and my budget will be to do the integration of the NNSA effort to ensure that all my documentation is complete and consistent with this type of weapon, and to do the work at my strategic weapons facilities, to do the loud-out change between the current configuration on the submarines and this new configuration.

Senator WARREN. Okay. So the NNSA is going to do the actual modification.

Admiral BENEDICT. Yes, ma'am.

Senator WARREN. The $22.6 million is so that you can—say that one more time?

Admiral BENEDICT. I need to do the integration of their effort with——

Senator WARREN. So it's to integrate.

Admiral BENEDICT. Yes, sir. Yes, ma'am, integrate with the system. I need to change all my documentation to ensure that I'm complete and consistent with nuclear weapons, and then I need to do the actual work at my strategic weapons facilities to change the warhead on the missiles. Yes, ma'am.

Senator WARREN. Okay. Thank you.

You know, I appreciate and I think you all understand why we're concerned about this. We're all familiar with NNSA's program management challenges in recent years, and given that track record, I find the number of unknowns that we heard before from the administrator and that still seem to be there worrisome. We're already asking them to conduct an unprecedented number of life cycle extension programs, along with other demands of the stockpile stewardship programs, and I just have real concerns about

their capacity to take on additional work. I think maintaining our current arsenal and our current programs should be our number-one priority and that we should manage that first.

Thank you very much. Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator Warren.

Senator Cotton?

Senator COTTON. Dr. Soofer, I want to speak to you first about Russia's pattern of behavior regarding their international commitments. Is Russia violating the INF Treaty?

Dr. SOOFER. Yes, it is, Senator.

Senator COTTON. Is Russia still violating the Open Skies Treaty?

Dr. SOOFER. I believe so, Senator.

Senator COTTON. We also know what happened in the United Kingdom a few weeks ago with the poisoning of two Russians. I know you aren't the lead for chemical weapons issues, but given what's been reported by our Government and the actions we've taken, is it fair to say that Russia has violated the Chemical Weapons Convention?

Dr. SOOFER. I don't know, Senator. I assume so.

Senator COTTON. I'll answer yes.

What about some other international agreements to which Russia is a party? The Budapest Memorandum, the Presidential Nuclear Initiatives, the Conventional Forces in Europe Agreement, the BNN document. Is Russia out of compliance with all of these in one way or another?

Dr. SOOFER. Yes, Senator.

Senator COTTON. What do you think this pattern of behavior tells us about how much Russia respects its international commitments?

Dr. SOOFER. I think they scorn their international commitments, and they're bent on upsetting the status quo.

Senator COTTON. So what about the New START Treaty? Is Russia complying with its obligations under New START?

Dr. SOOFER. We believe that they have met the limits. Yes, Senator.

Senator COTTON. After all the scorn they show for these other commitments, they are upholding their commitments under the New START Treaty. Why would that be?

Dr. SOOFER. I think it's a strategic approach. I think that they are limiting their strategic nuclear weapons while they circumvent this by building up their non-strategic nuclear weapons that are not limited by the treaty. I think it's a very clever approach.

Senator COTTON. So they are complying with their obligations under the treaty that tends to benefit them while they get the benefits of violating all of their other treaties.

Dr. SOOFER. Yes, sir.

Senator COTTON. Well, New START expires in about 3 years, but we'll have the option to extend it for another 5 years. Do you think it makes sense in this set of circumstances to extend the New START Treaty if Russia remains in violation of almost every other international agreement that they have made?

Dr. SOOFER. Senator, we're going to begin a whole-of-government review of the pros and cons of extending that treaty.

Senator COTTON. Thank you.

Finally, I want to address what President Putin said in his televised remarks last month about all kinds of new Russian capabilities. I don't think any of these capabilities were terribly surprising for people who have followed the matters. But would something like an intercontinental-range nuclear-powered cruise missile be covered under the New START Treaty? Or what about his so-called intercontinental underwater vehicle?

Dr. SOOFER. Senator, these are not covered by the New START Treaty.

Senator COTTON. So, all of the new systems he's announced are not covered by the treaty that benefits him, and he violates all the obligations under the other treaties that don't benefit him. Given that set of circumstances, I think we should take a serious second look at extending the New START Treaty.

Admiral Benedict, if I can turn to you, I noted in the Nuclear Posture Review that it said we would now field a fleet of at least—that's the quote, "at least"—12 *Columbia*-class SSBNs. I think the previous statement had been we would field 12 *Columbia*-class SSBNs. Does that mean that there is some thinking inside the Navy or the broader Department of Defense that we might need more than 12 *Columbia*-class submarines?

Admiral BENEDICT. Sure. I think that's a decision that will be made and a recommendation made by leadership as we approach the end of production. But I think, given the current changing world dynamic, we want to reserve the right to revisit that at some point.

Senator COTTON. So that's the import of those words "at least?"

Admiral BENEDICT. Yes, sir.

Senator COTTON. I think that's something we should entertain as well. I was glad to see that in the review, and thank you for that, Admiral.

Gentlemen, thank you again for your testimony today.

Senator FISCHER. Thank you, Senator.

We'll begin a second round of questions.

Dr. Soofer, the Nuclear Posture Review repeatedly makes the point that we have not made sufficient progress towards a responsive nuclear infrastructure despite the fact that it's been a longstanding goal that's been confirmed in previous NPRs. So with that in mind, can you describe how the Department is translating the NPR into specific guidance, and what processes will be put in place so we can assure a successful implementation?

Dr. SOOFER. Thank you, Senator. Just today, as a matter of fact, we put together a package or a memo to the Secretary of Defense that lists about 40 different actions following from the Nuclear Posture Review. Those actions are assigned to specific entities within the Department of Defense—Joint Staff, Army, Navy, OSD policy, STRATCOM. It's our recommendation that the Office of the Secretary of Defense review the progress twice a year and report to the Deputy and the Secretary on how well we're implementing these specific recommendations.

Again, there are about 40 different recommendations. Some of those recommendations speak directly to our hedging criteria and the need to have a more responsive nuclear infrastructure. I will note, however, that these implementation recommendations are

only for the Department of Defense and do not pertain to the Department of Energy. They would have their own procedures.

Senator FISCHER. Will the Department provide that implementation guidance to this committee?

Dr. SOOFER. I think as soon as the Secretary of Defense signs that, we should come up and brief you on the implementation plan.

Senator FISCHER. Thank you.

You mentioned hedging, and with the NPR we see that it emphasizes the importance of being able to hedge against the geopolitical and technical uncertainties that we're seeing out there.

To what extent is the Department reviewing its hedging strategies to ensure that they're keeping pace with this new threat environment?

Dr. SOOFER. Maybe I can start, but Secretary Roberts, given his affiliation with the Nuclear Weapons Council, may be better suited. But this idea of hedging is nothing new. Previous administrations have done it, and they've hedged against geopolitical changes, what happens if the relationship with Russia gets even worse and they break out of the New START Treaty and they start deploying more weapons? How do you hedge against that? Do you hedge against technical problems in your force?

Because our force is so old and we're in the process of recapitalizing every leg, we also have a new level of risk called programmatic risk or schedule risk. So what happens if the new systems don't come online in time before the old systems are retired? So we have to figure out a way to hedge against that possibility given the fact that sometimes programs are late.

So again, this is part of the NPR implementation tasking, but I think the Nuclear Weapons Council is looking seriously at this as well.

Senator FISCHER. Mr. Secretary, that also is an issue when we look at the NNSA's protection capacity, correct?

Secretary ROBERTS. Yes, yes.

Senator FISCHER. Would you like to continue from Dr. Soofer's comments on that?

Secretary ROBERTS. Well, first of all, I endorse everything he said. But also, the Nuclear Weapons Council and the subordinate bodies, because we have now created three other subordinate bodies, one on standing and safety, one on transformation coordination, and then one on compartmental issues and an advisory committee for that regard, what we're doing is we are taking on that accountability and enforcement, looking at the priorities.

Senator FISCHER. When you say we're taking it on, is that the Weapons Council?

Secretary ROBERTS. Yes, ma'am.

Senator FISCHER. Okay.

Secretary ROBERTS. Taking on those roles and responsibilities, in effect an enforcing function because of the criticality of the dates we've set out very explicitly in the Nuclear Posture Review. There is no margin for many of these programs. If we don't, we're going to have a gap, and that gap is going to adversely affect our deterrence to the point where it may not be credible. So that's very important. It will be difficult, but it's something that we absolutely have to do.

Senator FISCHER. Do you have any insight into the future in looking at how that road map is going to differ, perhaps, from any existing plans or requirements that we have out there now?

Secretary ROBERTS. I've been very——

Senator FISCHER. Or are you just right on schedule, right on point?

Secretary ROBERTS. I've never been very good at predicting the future.

Senator FISCHER. But you do have the flexibility to confront any changes that may be happening on the world stage?

Secretary ROBERTS. Yes, and that's part of my office's responsibilities, is that we'll be watching that very closely and identifying, in fact, and bringing to this committee any issues and problems that we see are important and that need to be addressed.

Senator FISCHER. Okay. Thank you very much.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chair.

Secretary Roberts, will the low-yield submarine ballistic missile warhead undergo the traditional 6.x review process the Nuclear Weapons Council has established for acquisition programs?

Secretary ROBERTS. Yes, it will.

Senator DONNELLY. This would be for General Rand. My understanding is that your organization has ownership of the National Emergency Airborne Command Post, or NEACP, a modified 747, which is aging out by the 2030s. How is its replacement coming along?

General RAND. Sir, there has been no money yet laid into the palm or the fight app for this, but I think we are going to begin some very serious discussions in the next weeks and months to follow, but not only about the NEACP but, if I could, about the family of systems that includes the Take Charge and Move Out, as well as the Airborne Command Post. So I will pitch my opinions and ideas to the Chief of Staff of the Air Force and to General Hyten, and there is no doubt a need to get very serious about this.

Senator DONNELLY. Because the follow-up question I had is are some of its missions going to be split amongst other aircrafts and other commands?

General RAND. No, sir, not at this time. We intend to keep the NEACP for what it's intended for the ability for the nuclear command and control communications, as well as to support Secretary of Defense. But we will keep those three, the Take Charge and Move Out that supports the Navy, and the Airborne Command Post, as well as how we use the NEACP.

Senator DONNELLY. Okay.

General RAND. I personally am in favor of looking at some commonality in that platform, though, for those three missions.

Senator DONNELLY. Thank you.

Admiral Benedict, what are we doing, or what do we need to be doing, to solve the radiation hardened microelectronic problem that seems to be looming?

Admiral BENEDICT. Yes, sir. That is not a Navy problem, that is not an Air Force problem. I believe that is a national problem, and I will tell you that the Department of Defense is extremely serious about taking that on at the Department level. OSD Industrial

Base, that group that manages industry, has formed a task force which has not just the Navy and the Air Force on it but also DTRA [Defense Threat Reduction Agency] and all the other interagency groups which will deal with radiation levels to an event of a nuclear capability. That is chaired by OSD Industrial Base, and the executive agent for that is actually Crane.

Crane has done all our nuclear rad hard piece part work for the D–5 life extension effort. We have procured enough parts to ensure that we can sustain the Trident II D–5 life extension effort through the 2040s. Our next need will be in the follow-on, which is directed in the NPR, and we are working closely with the United States Air Force. We passed the entire rad hard database that we developed for the life extension effort to the Air Force as part of commonality, and they will be the first ones to deal with the actual issue of reduced capacity for the rad hard industry in the U.S.

Senator DONNELLY. Thank you.

Admiral Benedict, what's the status for the rocket propellant industrial base?

Admiral BENEDICT. Sir, that remains, in my opinion, my professional opinion, fragile. We are down to, essentially, two major suppliers. If you were to segregate those between large capability and small to medium capability, we have one in each. Not only are we fragile in the major developers for solid rocket motors, we are seeing fragility within the suppliers of constituents, some of the necessary chemicals that make up a large percentage of a solid rocket motor. That is, again, being addressed in OSD at the Industrial Base Group through policy. We are working closely with the Industrial Base.

I'll just remind this committee, we are the only strategic asset that is in production today. We have maintained a minimum state of production for the Trident II D–5 rocket motors in order to ensure that there is capacity. That skill set does remain alive, and we are producing at the minimum sustaining safe rate for the Trident rocket motors. The next, again, large rocket motor production requirement will be the Air Force GBSD [Ground-Based Strategic Deterrent] effort.

Senator DONNELLY. Thank you.

Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator.

Senator Peters?

Senator PETERS. Thank you, Madam Chair.

Thank you for all four of your testimonies here today and for your service to the country. We appreciate it.

Dr. Soofer, I'd like to start with you and ask you a little bit about missile defense. I understand the NDAA is reviewing three potential locations for a continental U.S. interceptor site to join the current sites that are out there. One of the locations under consideration is Fort Custer Training Center, as you know, in Michigan, and my understanding is that that site is shovel ready. It provides the lowest cost, the least environmental impact options out there, which we're very proud of.

In last year's STRATCOM posture hearing, General Hyten testified that it would likely take 5 to 10 years to construct a third site once the decision is made. This is not something, obviously, that

you can just turn on. As a result of that, I would agree with Senator Sullivan, who suggested that we need this report as soon as possible so we can inform the NDAA and be thinking through some of these strategic implications going forward.

So my question for you is, what are the criteria and priorities that the NDAA will consider when selecting a preferred site for the continental interceptor site, as required?

Dr. SOOFER. Senator, I think the Missile Defense Review will try to address some of that. If I could just talk generally about the types of criteria——

Senator PETERS. That would be great.

Dr. SOOFER. You have to ask yourself, what is the threat you're protecting against? If it's mostly coming from the east, say from the Middle East, there's one location. If you want to get the Middle East and provide additional protection from North Korea, you might choose a different site. Are you trying to maximize your battle space, get as many shots off as possible, have what's called a shoot opportunity? That will dictate which site.

So all three of those in terms of getting input from the warfighter, balancing it against the threat, and the ease of construction, I think those are all being weighed.

Senator PETERS. In the full committee recently, actually in February, I asked General Robinson about the missile threat from Iran, and she indicated—I'll quote her statement in the committee. She said she "watches North Korea with an eyeball and a half, and then a half an eyeball on Iran."

So from a battle space perspective, what are the current consequences—or I should say what would be the consequences for the current GMD [Ground-Based Midcourse Defense] system if Iran were to develop a ballistic missile capability that would threaten the United States?

Dr. SOOFER. Based on our analysis during the missile defense review—and I think this is supported by the previous administration's findings—you can actually protect most of the United States against an Iranian threat from the interceptors at Fort Greeley, as long as you have the proper sensor support on the east side. You may recall that we had plans to build a long-range discriminating radar in Alaska to help discriminate the threat from North Korea. You have to do the same from Iran.

So there is some inherent capability today to defend against Iran, but it depends on the complexity of the Iranian threat. If they have more warheads, more counter-measures, then the system in Fort Greeley would not suffice and it would make sense to have an additional site, a third site somewhere else to deal with that threat.

Senator PETERS. Areas such as Michigan, New York, and Ohio that are being considered, something towards the Midwest or East would be the place to have it, would be the natural site for it?

Dr. SOOFER. Yes, sir.

Senator PETERS. So the question, though, as you mentioned, we may have that capability, unless the system is more sophisticated. However, given the fact that we have to look 5 to 10 years out and that's not an easy task to do, but it's probably safe to assume that if they should get that capability, they will constantly be improving it over that time, that we need to be making these plans now. So

that process, there's a balancing act of what we can do now and what we must do in the future. How do you weigh those?

Dr. SOOFER. Exactly right, sir. I'll be honest with you that one of the greatest areas of uncertainty is the nature of the threat. We can share with you the information we have in the intelligence world and have a more fulsome discussion about that, but then there's also the issue of cost.

Senator PETERS. Of course.

Dr. SOOFER. To go to an additional site, I'm thinking about $5 billion. Others say the priority should be sensors in space, or a multiple kill vehicle, so we have to weigh those.

This committee had some very significant debates over an East Coast missile defense site, and I think where they came down was it's a hedge against the Iranian threat to go forward with a sensor. So there is a requirement for an Atlantic radar.

All these considerations are important. What happens to the future of the agreement with Iran? This could all impact the nature of the threat, and I think that's going to be weighed in the final Missile Defense Review, sir.

Senator PETERS. Right. Thank you for your response, appreciate it.

Senator FISCHER. Thank you, Senator.

I have one last question for the Admiral and the General. I would be interested in knowing your views on the NPR, if you support it, if you see it as enhancing our ability to deter our adversaries.

General RAND. Madam Chair, as I told you this morning, I believe it's a good, sound document, and in my mind it's what the 11 previous administrations supported. It states the fact that there's a requirement for the triad to continue, that it needs to be lethal, and it should be used only in extreme circumstances. I like the fact that that is our declaratory policy, and I think it is a good guideline for setting the tone for deterrence and assurance.

Senator FISCHER. Thank you, sir.

Admiral?

Admiral BENEDICT. Yes, ma'am. I would echo what General Rand said. We were supportive during the development of the NPR. We stand fully in a supporting role of being able to deploy a low-yield weapon on the Trident weapon system as quickly as possible, and I believe it actually enhances deterrence. Yes, ma'am.

Senator FISCHER. Thank you, sir.

Senator Donnelly, did you have other questions?

Senator DONNELLY. No, Madam Chair.

Senator FISCHER. Okay. With that, I would like to thank our panel of witnesses for coming before this committee today. Your information is always very helpful to us.

We extend our best wishes to General Rand and Admiral Benedict for your many years of service to this country. Thank you very much.

We are adjourned.

[Whereupon, at 3:39 p.m., the subcommittee adjourned.]

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR DEB FISCHER

STOCKPILE RESPONSIVENESS PROGRAM

1. Senator FISCHER. Secretary Roberts, Dr. Soofer, the nuclear posture review emphasizes the importance of the NNSA's Stockpile Responsiveness Program (SRP). Please describe the Department's views of this program and the unique contribution it makes to the long-term future of our nuclear enterprise.

Secretary ROBERTS. The Stockpile Responsiveness Program established by Congress directs National Nuclear Security Administration (NNSA) to continually exercise all capabilities required to conceptualize, study, design, develop, engineer, certify, produce, and deploy nuclear weapons. The SRP makes a unique and critical contribution to ensure the nation has a resilient and responsive nuclear weapons infrastructure. This program is critical to achieve the objectives of the Nuclear Posture Review (NPR) and could include: i. Development of rapid prototyping capabilities; ii. Development of options for modifying warheads to increase flexibility and responsiveness; iii. Surveying past and extant warhead designs to understand what can be certified without resuming full-scale nuclear testing; and iv. Reducing the time required to design, develop, and initially produce a warhead.

Dr. SOOFER. The Stockpile Responsiveness Program (SRP) established by Congress directs National Nuclear Security Administration (NNSA) to continually exercise all capabilities required to conceptualize, study, design, develop, engineer, certify, produce, and deploy nuclear weapons. The SRP makes a unique and critical contribution to ensure the nation has a resilient and responsive nuclear weapons infrastructure. This Program is critical to achieve the objectives of the 2018 Nuclear Posture Review (NPR) and include: 1) development of rapid prototyping capabilities; 2) development of options for modifying warheads to increase flexibility and responsiveness; 3) surveying past and extant warhead designs to understand what can be certified without resuming full-scale nuclear testing; and 4) reducing the time required to design, develop, and initially produce a warhead.

2. Senator FISCHER. Secretary Roberts, Dr. Soofer, will the Department playing a role in setting the goals or selecting the projects this program will pursue?

Secretary ROBERTS. DOD will work with DOE/NNSA to identify DOD's roles and responsibilities; and identify a mechanism to establish governance to coordinate SRP activities.

Dr. SOOFER. DOD will work with the Department of Energy (DOE)/NNSA to identify DOD's roles and responsibilities; and identify a mechanism to establish governance to coordinate Stockpile Responsiveness Program activities.

SEA-LAUNCHED CRUISE MISSILE (SLCM)

3. Senator FISCHER. Dr. Soofer, please provide an anticipated timeline and associated milestones for the Department's Analysis of Alternatives (AOA) for the sea-launched cruise missile?

Dr. SOOFER. The U.S. Navy is working closely with the Joint Staff and the Office of the Under Secretary of Defense for Policy to evaluate options for a nuclear sea-launched cruise missile (SLCM) based on the policy guidance reflected in the 2018 NPR. This evaluation process, which is ongoing, will include an Analysis of Alternatives (AOA), as well as timelines and milestones.

4. Senator FISCHER. Dr. Soofer, what organization will lead the AOA?

Dr. SOOFER. The U.S. Navy, working closely with the Joint Staff and the Office of the Secretary of Defense.

5. Senator FISCHER. Secretary Roberts, Dr. Soofer, the AOA will presumably analyze alternatives related to the missile body and the platform, but the SLCM will also require a warhead. Will the AOA analyze alternatives related to which warhead will be mated with the missile, and if not, how and when will the Department synchronize the SLCM program with an NNSA warhead program?

Secretary ROBERTS. In concurrence with the Analysis of Alternatives AOA, the nuclear weapons joint lifecycle process will provide the Nuclear Weapons Council with options for evaluation regarding the most appropriate sea-launched cruise missile (SLCM) warhead. The selected warhead will undergo a deliberate and detailed analysis in order to validate its suitability in meeting military requirements.

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(SLCM) warhead. The selected warhead will undergo a deliberate and detailed analysis in order to validate its suitability in meeting military requirements.

NUCLEAR ENTERPRISE REVIEWS

6. Senator FISCHER. General Rand, in 2014, the Department made a series of recommendations that were intended to improve morale and operations at the missile wings. Some of these recommendations were implemented and closed out—like, for example, the elevation of the Commander of Global Strike Command to a four-star billet. Others are ongoing. Initially, the DOD Office of Cost Assessment and Program Evaluation was tasked with monitoring the implementation of the recommendations, but in December of 2016 that responsibility was transferred to the Navy and the Air Force.

How is the Air Force monitoring the implementation of the recommendations?

General RAND. AFGSC developed a regular mechanism to reinforce the progress we've made since the Nuclear Enterprise Review (NER) and ICBM and Bomber Force Improvement Programs (FIP) in order to ensure continued improvement. The Global Strike Health and Operations Board and Council (GSHOB/C) is one venue where commanders from across AFGSC gather monthly to review airmen, commander, and stakeholder inputs for improvement and tracking progress. This avenue provides every Striker a direct line of communication to the AFGSC Commander on how to improve our capability, capacity, and human capital. The meticulous tracking of every input guarantees all ideas are explored, identifies root causes, and implements long-term, sustainable solutions. This forum identifies and shares Best Practices across all organizations within the command and allows the AFGSC Commander to adapt and modify the venue to proactively respond to areas identified for command-wide focus, ensuring future generations do not repeat previous findings/shortcomings. Additionally, this forum validates items that have been worked and subsequently closed. Specifically, validation looks at items closed 6 to 12 months prior to the meeting and aims to ensure actions taken corrected the identified shortcoming, have been built into a repeatable process and are enduring. In addition to the monthly GSHOB/C review of NER and FIP actions, AFGSC/A9 conducts Airmen Driven Innovation (ADI) analyses. The ADI is a preventative, functionally-focused initiative designed to provide airmen at all levels with a voice to our senior leadership to communicate potential areas that need attention. It is comprised of a cross-functional team to rapidly implement solutions or engage other staff processes, and serves as a feedback mechanism to keep Striker Airmen, leadership and AFGSC Staff informed of our findings, progress, and organizational changes. ADI findings are tracked separately from FIP items through the GSHOB/C forum, but findings are cross-referenced to FIP and additional reports or studies as a trending analysis tool. In 2017, AFGSC hired a panel of independent consultants to provide an external assessment of the health of the Air Force Nuclear Enterprise. The Independent Strategic Assessment Group (ISAG) is comprised of former DOD leaders. The ISAG conducted a deep dive into numerous key areas, including current management structure and practices of the Nuclear Enterprise, and how AFGSC can field a more lethal force. The assessments informed AFGSC staff and resulted in the development of action items the command is tackling so we can more effectively accomplish our deterrence and global strike missions. Going forward, we will continue using this independent look to help promote innovation, change, and ultimately improvement throughout the command. Finally, we stood up the Family and Airmen Support Team (FAST) to identify ways we can improve where our airmen learn, live, play, receive medical and child care, and overall well-being. AFGSC hosts an annual conference to build initiatives in four major working groups: Airmen and family maintenance, physical environment, sustaining the family, and training and educating airmen.

7. Senator FISCHER. General Rand, does the Air Force plan on conducting an enterprise-wide assessment of the health of the missile force?

General RAND. The health of the ICBM community is routinely analyzed and assessed several venues. The National Mission Assessment (NMA) is a comprehensive assessment of the nuclear mission that is congressionally directed, led by HAF/A10, and provided to the SECAF and CSAF. The assessment is organized by component (e.g. B–52, MMIII) across five performance areas. Performance measures focus on human capital, readiness, sustainment, modernization and effectiveness. This program helps break down information stovepipes across organizations and helps determine interdependencies between components and performance areas. In addition to the NMA, AFGSC has the tools to regularly assess the missile force. Such tools include Airmen Driven Innovation (ADI) events, a functionally-focused initiative to

provide airmen at all levels with a voice to our senior leadership. Furthermore, AFGSC has implemented the No-Notice On-Site Visit (NNOSV) program which provides another touchpoint to assess the health of the force. NNOSVs are observations focused on Operations, Security Forces, Maintenance, People/Profession of Arms, and Support, providing an independent assessment of unit health, operational readiness, and lethality.

8. Senator FISCHER. General Rand, the Force Improvement Program (FIP) received credit for generating significant positive change within the culture and climate of the missile wings. That program officially ended last year. How will you ensure that those gains are not lost now that FIP is no longer official Air Force policy?

General RAND. The initiatives undertaken by the SECAF and CSAF to support commanders down to the squadron level have provided commanders the most freedom of maneuver and authority to operate in recent years. AFGSC has expanded this effort through our own delegation of authorities initiative. Additionally, AFGSC hosts multiple events such as the Squadron Commander Course and monthly VTCs with wing leadership so leaders at multiple levels have several routine touch points to discuss past, present, and on-going initiatives. This approach ensures "the way it has always been" is not the reason for execution; rather, commanders are charged with effective and efficient mission accomplishment and continual unit improvement on a regular basis. In addition to these regular touch points with new and sitting commanders, AFGSC's "Striker Culture" has been developed, defined and inculcated throughout the command. Our AFGSC culture slide was written by the airmen of AFGSC and approved by AFGSC senior leaders. The building blocks to guarantee positive change are well established with current and future leaders in AFGSC. AFGSC developed a regular mechanism to reinforce the progress we've made since the Nuclear Enterprise Review (NER) and ICBM and Bomber Force Improvement Programs (FIP) in order to ensure continued improvement. The Global Strike Health and Operations Board and Council (GSHOB/C) is one venue where commanders from across AFGSC gather monthly to review Airmen, commander, and stakeholder inputs for improvement and tracking progress. This avenue provides every Striker a direct line of communication to the AFGSC Commander on how to improve our capability, capacity, and human capital. The meticulous tracking of every input guarantees all ideas are explored, identifies root causes, and implements long-term, sustainable solutions. This forum identifies and shares Best Practices across all organizations within the command and allows the AFGSC Commander to adapt and modify the venue to proactively respond to areas identified for command-wide focus, ensuring future generations do not repeat previous findings/shortcomings. Additionally, this forum validates items that have been worked and subsequently closed. Specifically, validation looks at items closed 6 to 12 months prior to the meeting and aims to ensure actions taken corrected the identified shortcoming, have been built into a repeatable process and are enduring. In addition to the monthly GSHOB/C review of NER and FIP actions, AFGSC/A9 conducts Airmen Driven Innovation (ADI) analyses. The ADI is a preventative, functionally-focused initiative designed to provide Airmen at all levels with a voice to our senior leadership to communicate potential areas that need attention. It is comprised of a cross-functional team to rapidly implement solutions or engage other staff processes, and serves as a feedback mechanism to keep Striker Airmen, leadership and AFGSC Staff informed of our findings, progress, and organizational changes. ADI findings are tracked separately from FIP through the GSHOB/C forum, but findings are cross-referenced to FIP and additional reports or studies as a trending analysis tool. In 2017, AFGSC hired a panel of independent consultants to provide an external assessment of the health of the Air Force Nuclear Enterprise. The Independent Strategic Assessment Group (ISAG) is comprised of former DOD leaders. The ISAG conducted a deep dive into numerous key areas, including current management structure and practices of the Nuclear Enterprise, and how AFGSC can field a more lethal force. The assessments informed AFGSC staff and resulted in the development of action items the command is tackling so we can more effectively accomplish our deterrence and global strike missions. Going forward, we will continue using this independent look to help promote innovation, change, and ultimately improvement throughout the command. Finally, we stood up the Family and Airmen Support Team (FAST) to identify ways we can improve where our Airmen learn, live, play, receive medical and child care, and overall well-being. AFGSC hosts an annual conference to build initiatives in four major working groups: Airmen and family maintenance, physical environment, sustaining the family, and training and educating Airmen.

NUCLEAR COMMAND, CONTROL AND COMMUNICATIONS (NC3)

9. Senator FISCHER. General Rand, please describe the current approach to developing Air Force officers qualified to be effective leaders in NC3 acquisition, architecture, and operations.

General RAND. Developing leaders in Nuclear Command, Control, and Communications (NC3) is an ongoing process. Initially, officers train and certify in their core nuclear mission according to their Air Force Specialty Code (AFSC). Examples include ICBM operators, pilots, and combat systems officers. Mid-level education opportunities include the USAF Weapons School, organized by weapon system, and Intermediate Developmental Education programs with a nuclear concentration. Although there is no NC3 AFSC, all officers who fill these billets are designated with a special duty identifier. The NC3 officers are selected by interview from a pool of prior nuclear certified officers and receive training on Joint Nuclear Command and Control procedures and NC3 equipment. Additionally, they complete a locally graded certification before they are considered certified in NC3 operations. There are no specific NC3 acquisition and architecture officers. NC3 uses general acquisition officers and civilian architects and trains them in NC3 background, history, and policies. They will receive on-the-job training on the NC3 systems they are assigned. Acquisition leadership positions fall into two categories. Material Leaders (MLs) are typically responsible for a moderately sized program or several small programs. To be minimally qualified for an ML position, an officer must be a Lieutenant Colonel or Colonel and have achieved a Defense Acquisition Workforce Improvement Act (DAWIA) Level II Certification in Program Management. Generally speaking, this requires at least one tour in a Program Office with duties that involve cost, schedule, and performance on an acquisition program in addition to educational and formal acquisition training requirements. Senior Material Leaders (SMLs) are typically responsible for a large program of national significance or a portfolio of multiple programs. To be qualified for an SML position, an acquisition Colonel must have DAWIA Level III Certification in Program Management. Similar to a Level II Certification, a Level III Certification requires several years of experience with cost, schedule, and performance on an acquisition program. In this case, the minimum tenure is four years with additional formal acquisition training. Once determined qualified for ML or SML positions, officers are matched to specific positions commensurate with their background and experience. For NC3 acquisition leadership positions, some combination of prior experience in the acquisition, sustainment or operation of nuclear, command and control, or communications systems is desired.

10. Senator FISCHER. General Rand, please describe the process by which officers are selected and assigned into program management roles for NC3-related acquisition programs?

General RAND. For Material Leader (ML) selection, interested and qualified officers are first vetted through a boarding process, chaired by senior acquisition leaders within the Air Force, to include at least one General Officer and Senior Civilian (SES). For Senior Material Leader (SML) selection, the CSAF has directed that all qualified Colonels compete for SMLs and other leadership opportunities on the CSAF's Command Screening Board. This board is comprised of Senior Air Force Leaders. In either case, the vetted MLs and SMLs are then bid into Program Manager Positions by Senior Air Force Acquisition Leaders based on background and level of experience. For example, the largest acquisition programs (ACAT I) require at least eight years of experience handling cost, schedule, and performance work on an acquisition program.

11. Senator FISCHER. General Rand, please describe the training or education they receive relating to the NC3 enterprise.

General RAND. Beginning in 2017, the Air Force Nuclear Command, Control, and Communications Center (AFNC3C), in conjunction with the Air Education and Training Command (AETC) has been conducting NC3 150, a training course available to the NC3 community. The purpose of this course is to provide initial Nuclear Command, Control, and Communications training. There are four main topic areas that cover nuclear deterrence (history and strategy), organizational and command relationships essential to the NC3 mission, operational dimensions of NC3, and finally the future challenges the NC3 community faces. This course is available to officers, enlisted and civilian personnel recently assigned to NC3 billets. Additional courses (NC3 200, 300, and 400) are in development and will provide further development opportunities for NC3 leaders. AFNC3C and AETC are also offering Distance Learning courses in NC3 Systems Engineering and Deterrence to selected in-

dividuals awarding certificates, Bachelors, Masters, Doctorates degrees or providing specific education as needed.

12. Senator FISCHER. General Rand, are you satisfied with the selection process and level of training, or are there areas you believe could be improved upon?

General RAND. AFGSC is aggressively pursuing ways to improve the selection process and level of training in Nuclear Command, Control, and Communication (NC3). Accessions to the Air Force NC3 Center have expertise in their functional specialty and we are working to expand their NC3 expertise. We are on a good path moving forward. The Air Force NC3 Center is developing an integrated training plan to increase NC3 knowledge for both junior and senior officers, as well as enlisted and civilian Airmen. We have engaged the Air Force's Air Education and Training Command (AETC) and the Air Force Nuclear Weapons Center (AFNWC) to develop and deliver a multi-level NC3-focused curriculum. The first of these courses, NC3 150, was delivered in December 2017. While these efforts are still in their infancy, AFGSC is optimistic this training will provide the requisite breadth of knowledge for all personnel, and will guarantee the Air Force's continual focus on the NC3 Enterprise.

HEDGING

13. Senator FISCHER. General Rand, the 2018 Nuclear Posture Review (NPR) emphasizes the need to hedge against future uncertainty and states: "This requires maintaining the U.S. capacity to upload hedge weapons onto existing delivery platforms to augment the deployed force as necessary if, for example, an unexpected operational or technical problem were to arise in U.S. forces."

General RAND. I concur with this statement. I have provided a classified annex to further expand on this topic.

14. Senator FISCHER. General Rand, Admiral Benedict, please describe the upload process, including the expected timeline for completion if the Department were asked to begin immediately and readiness of forces to execute such orders.

General RAND. The upload process for hedge purposes applies to the Minuteman III (MMIII) ICBM. The MMIII is capable of being uploaded with two or three MK12A reentry vehicles each. The MK21 reentry vehicle can only be configured as a single reentry vehicle. Upon order from USSTRATCOM, AFGSC would partner with HAF/A4, the AF Nuclear Weapons Center, and NNSA, to flow build-up materials to each of the three missile wings. Each wing is designated for a rough equivalency share of uploading requirements, balancing the workload across the fleet. The specific number of ICBMs designated for upload and the required timeline is provided in a classified annex.

Admiral BENEDICT. U.S. Strategic Command (USSTRATCOM) is responsible for the strategic war plan, to include strategic hedge requirements. The Navy remains confident in its ability to meet USSTRATCOM requirements and can brief you in a classified forum on the requirements, associated timelines, and the implications of potential changes to these requirements.

15. Senator FISCHER. General Rand, Admiral Benedict, what steps could the Department take in order to reduce that timeline or increase readiness of the forces?

General RAND. In order to ensure timely response to hedge, AFGSC A4 has received approval from HAF A4LR to build High Priority Mission Support Kits (HPMSK) at each missile wing allowing for immediate access to build-up materials. Use of HPMSKs will institutionalize hedge mission requirements; affording AFGSC a formal channel for programming and reporting hedge related assets through the Air Force's corporate process. Additionally, a Unit Type Code (UTC) is currently under development for hedge requirements with the intent to include HPMSKs within that UTC. Both measures will keep Air Force and Combatant Commanders apprised of hedge readiness. Please see classified annex on SIPRNet for additional information.

Admiral BENEDICT. U.S. Strategic Command (USSTRATCOM) is responsible for the strategic war plan, to include strategic hedge requirements. The Navy remains confident in its ability to meet USSTRATCOM requirements and can brief you in a classified forum on the requirements, associated timelines, and the implications of potential changes to these requirements.

ADVERSARY DEVELOPMENTS

16. Senator FISCHER. General Rand, we have low-yield nuclear weapons in our triad's airborne leg; how is the development of advanced air defenses impacting our ability to hold targets at risk with these weapons?

General RAND. Fielded in the 1980s, the Air Launched Cruise Missile (ALCM) is over 30 years old, well beyond its life expectancy, and is involved in its third life extension program (LEP). While the ALCM remains effective today, we must replace it due to its aging subsystems, the shrinking stockpile of operational missiles, and advances in enemy defenses. Advanced air defense systems increase the risk to aircrew and the weapons. Russia and China are quickly advancing their air defense technologies; advances in computer processing, digital networking technology, and targeting systems enable air defenses to better detect U.S. assets. Future systems, specifically the Long Range Stand-Off missile and the B–21 Raider will provide enhanced capabilities against these defenses.

WARHEAD STOCKPILE STRATEGIC PLAN

17. Senator FISCHER. Secretary Roberts, the Nuclear Posture Review (NPR) states: "To provide the required strategic vision needed to inform critical warhead modernization investments, the DOD and DOE Nuclear Weapons Council approved a strategic plan. This plan describes a current and future path for the nuclear warhead stockpile to meet deterrence, assurance, and technical hedging requirements."

Please describe the new strategic plan, its key differences from pre-existing plans, and whether the new strategic plan still envisions a final composition of 3 interoperable ballistic missile warheads deployed on both the SLBM and ICBM legs of the Triad and 2 interoperable air-delivered warheads or bombs.

Secretary ROBERTS. As the NPR notes, we are now in the early stages of a comprehensive warhead sustainment program. The Nuclear Weapons Council approved the most recent Fiscal Year17–42 Strategic Plan in 2016 and is currently revising that plan to account for the findings of the NPR. The Council expects the revised plan to be completed by the end of the year.

QUESTIONS SUBMITTED BY SENATOR JOE DONNELLY

PLUTONIUM PIT PRODUCTION

18. Senator DONNELLY. Dr. Soofer, are you concerned about the DOE NNSA's ability to produce 80 plutonium pits per year by 2030 as mandated in the statute?

Dr. SOOFER. Based on NNSA's engineering assessment, the schedule to reach 80 war reserve pits per year is extremely challenging. Any approach to achieve this objective will require leadership and intense focus by DOD and NNSA to meet the 2030 timeline. The NWC will exercise regular oversight and monitoring of this effort.

SEA-LAUNCHED CRUISE MISSILE

19. Senator DONNELLY. Dr. Soofer, the Nuclear Posture Review proposes a sea launched cruise missile to replace the one dropped in the 2010 NPR. I don't want to pre-judge your analysis but many people for a long time, going back as far as the Regulus program in 1955, thought about which sea platform to put such a system on. Each time they came back to a submarine. What's different this time?

Dr. SOOFER. The U.S. Navy is working closely with the Joint Staff and the Office of the Under Secretary of Defense for Policy to evaluate options for a nuclear sea-launched cruise missile (SLCM) based on the policy guidance reflected in the 2018 NPR. The platform for the SLCM will be determined as part of the Analysis of Alternatives (AOA) evaluation.

OASD (NCB) STAFFING

20. Senator DONNELLY. Secretary Roberts, the Office of the Secretary of Defense has been undergoing a lot of organization and staffing changes with the split up of the Undersecretary for Acquisition and Logistics into two—one for Acquisition and Sustainment and one for Research. Do you have adequate staffing to do your job?

Secretary ROBERTS. We are sufficiently staffed for our current portfolio of responsibilities. As our portfolio continues to evolve, however, our staffing levels will require constant reevaluation in order to ensure our responsibilities are fulfilled to the highest possible standard.

OASD (NCB) AND DTRA

21. Senator DONNELLY. Secretary Roberts, my understanding is that the Defense Threat Reduction Agency, like other field support agencies, will report directly to the Undersecretary for Acquisition and Sustainment. Before, it reported to you, given the extensive amount of work in nuclear weapons and non- and counter-proliferation it performed. What oversight do you now have of this field support agency?

Secretary ROBERTS. A final decision on the organizational reporting structures within Office of the Under Secretary of Defense for Acquisition and Sustainment (OUSD(A&S)) and OUSD(R&E) is expected to be announced by the Deputy Secretary soon after June 1. I am not aware of, nor do I anticipate, any disruptive changes to the reporting relationship between NCB and the Defense Threat Reduction Agency (DTRA). Under the current reporting relationship, in accordance with DOD Directive 5134.08 and on behalf of the USD(A&S), the ASD(NCB) exercises authority, direction, and control over the Director of DTRA.

COCOMS AND NUCLEAR OPERATIONS PLANNING

22. Senator DONNELLY. Dr. Soofer, U.S. Strategic Command traditionally performs all nuclear operations planning. Do you believe the Combatant Commands should also have such a capability and are you concerned whether they do or don't have one?

Dr. SOOFER. It is not necessary to replicate U.S. Strategic Command's (USSTRATCOM) capabilities across multiple Combatant Commands. The Department of Defense has been working with the Combatant Commands and Military Departments and Services to identify capabilities necessary to enable the United States to respond in a regional conflict should deterrence fail. This approach is reinforced in the 2018 NPR, which states that the United States will strengthen the integration of nuclear and non-nuclear military planning. Specifically, the Combatant Commands and their Service components will be organized and resourced for this mission, and they will plan, train, and exercise to integrate U.S. nuclear and non-nuclear forces to operate in the face of adversary nuclear threats. This includes developing a cadre of personnel within the Combatant Commands with knowledge of nuclear operations, identifying and sourcing any necessary augmentation that might be needed in a conflict, strengthening command and control relationships, and deploying equipment necessary to enable the Combatant Commanders to conduct secure communications.

ROLE OF 20TH AND 8TH AIR FORCE(S)

23. Senator DONNELLY. General Rand, U.S. Strategic Command has placed you in charge of ICBM and bomber operations. In prior years, the 20th and 8th Air Force(s) were the direct report to STRATCOM for bomber and ICBM operations. What is their role under this new construct?

General RAND. Previously, 8 AF and 20 AF were dual-designated Task Force 204 and Task Force 214 respectively. Operational control flowed from USSTRATCOM through these task forces to their subordinate wings. Operational control now flows from USSTRATCOM through the Commander, Air Forces Strategic-Air (AFSTRAT–Air), dual-hatted as the Commander, Air Force Global Strike Command. This presents a single Air Force commander to USSTRATCOM for assigned forces. Both 8 AF and 20 AF have retained their service administrative control (ADCON) responsibilities, and their supporting organize, train, and equip (OT&E) responsibilities. Day-to-day operational direction flows from USSTRATCOM to AFSTRAT–Air to the 8 AF and 20 AF commanders. These commanders continue to be responsible for their wings' compliance with and execution of orders either from USSTRATCOM or AFSTRAT–Air. Plus, they are responsible for ensuring their wings comply with service policy and guidance, are resourced for mission requirements, and that they are trained and capable of executing assigned missions. There is a direct supervisor-subordinate relationship between the wing commanders and their assigned number air force commander.

AFGSC WEAPONS STORAGE AREAS

24. Senator DONNELLY. General Rand, I understand you are having cost growth issues with replacing the weapons storage areas for the missile and bomber wings. What is going on and what are you doing to contain the cost growth?

General RAND. When the bids for the FE Warren Weapon Storage Facility (WSF) came in higher than expected, AFGSC took the following actions with all WSF stakeholders: We analyzed the bids to identify high cost drivers Conducted a two

week High Performance Team (HPT) event to scrub operational/institutional requirements and WSF designs to ensure we had the right balance between combat lethality, risk, and cost Implemented a series of Program Control events to baseline source documents, improve the control process, and improve the WSF program oversight/approval process As a result of this initiative, we eliminated a $439 million plus material handling development requirement and lowered expected costs for the first three WSFs by over $200 million. Going forward, the Program Control process will enable us to maintain tight control of WSF scope, cost, and schedule.

NEXT GENERATION SUBMARINE-LAUNCHED BALLISTIC MISSILE

25. Senator DONNELLY. Admiral Benedict, I understand you are now looking to a new strategic missile system to be introduced into the *Columbia*-class. What are the major issues you will concentrate on for this new missile system?

Admiral BENEDICT. The Navy is extending the life of the Trident II (D5) strategic weapon system (SWS) until the 2040s to match the hull life of the *Ohio*-class SSBN and serve as the initial delivery and payload system on the *Columbia*-class SSBN. The Navy is also beginning to study how to maintain a credible and effective SWS beyond 2040 by leveraging the work that is being done today to extend the Trident II (D5) SWS, as well as investigating opportunities to innovate through the application of model-based engineering. In fact, the Nuclear Posture Review directs that the Navy "begin studies in 2020 to define a cost-effective, credible, and effective SLBM that we can deploy throughout the service life of the *Columbia* SSBN." These studies will determine the most appropriate and cost-effective combination of pull-through technologies and modernized components to meet U.S. Strategic Command requirements, address technology obsolescence, and allow for sufficient future flexibility in an evolving security environment. The Navy will focus these studies on ensuring industrial base capacity, payload flexibility, survivability, system performance, operational availability, and planning efficiency.

QUESTIONS SUBMITTED BY SENATOR MARTIN HEINRICH

PLUTONIUM STRATEGY

26. Senator HEINRICH. Secretary Roberts, the Nuclear Posture Review reaffirms the military requirements for plutonium pit production of 30 per year by 2026, ramping up to 80 by 2030. The initial capability of 30 per year will be at Los Alamos. The source of the additional capacity is still under review by the Nuclear Weapons Council. I believe this process has taken far longer than necessary. What is the status of the council's review and agreement on a path forward for pit production?

Secretary ROBERTS. USD (A&S) Lord and NNSA Administrator Gordon-Hagerty have agreed on a path forward that repurposes the Mixed-Oxide Fuel Fabrication Facility at the Savannah River Site to produce at least 50 pits per year, and to continue to invest in Los Alamos National Laboratory to produce at least 30 pits per year. This path forward is acceptable to the Secretary of Defense and the Nuclear Weapons Council (NWC) as a resilient and responsive option to meet DOD requirements. The NWC recognizes that there are major construction and certification schedule risks with this or any path forward on plutonium pit production. The NWC will be exercising regular coordination and monitoring of progress, and seeking opportunities to reduce risk.

27. Senator HEINRICH. Secretary Roberts, has the Department's Cost Assessment and Program Evaluation Office, or "CAPE," been charged to do an independent review?

Secretary ROBERTS. Section 3141 of the National Defense Authorization Act for Fiscal Year 2018 requires CAPE to conduct a reconciliation of its 2013 CAPE plutonium production capability review with the Department of Energy (DOE)/NNSA's recommended alternative. CAPE's subsequent review of the 2018 NNSA Plutonium Engineering Assessment (EA) indicates the acquisition cost estimates included in the EA appear consistent and were reconciled with the 2013 review outcomes.

28. Senator HEINRICH. Secretary Roberts, in your view, will the goal of 80 pits per year by 2030 be met and will the council meet the deadline of May 11th to make a recommendation?

Secretary ROBERTS. The NWC met the deadline of May 11, 2018, to provide its certification of DOE/NNSA's recommended alternative. NNSA delivered its recommended alternative, supporting materials, and the NWC Chairwoman's certifi-

cation letter to the congressional defense committees on May 10. We will continue to work closely with NNSA to achieve the goal of 80 pits per year by 2030.

FY19 NNSA AUTHORIZATION

29. Senator HEINRICH. Dr. Soofer, NNSA's FY18 appropriation and FY19 budget request fully support the program of record for stockpile and modernization programs, but any specific new military requirements of the NPR have not been defined by the Nuclear Weapons Council. Will the DOD and NNSA be submitting modifications soon for the FY19 budget request so that the committee can properly consider any new authorizations required?

Dr. SOOFER. The Department of Defense (DOD) is in the process of implementing the outcomes of the 2018 Nuclear Posture Review (NPR), including defining military requirements for supplemental capabilities such as the W76–2 warhead and the sea-launched cruise missile. These requirements will be integrated into DOD and Department of Energy/National Nuclear Security Administration (DOE/NNSA) guidance, including among other things a revised Nuclear Weapons Council Strategic Plan.

The fiscal year 2019 budget request for the DOD included funding for NPR priorities including sustainment of existing systems and continued investment in recapitalization programs. The fiscal year 2019 budget request for NNSA is being amended to fund the W76–2 warhead. For details on NNSA's fiscal year 2019 budget request, I refer you to my colleagues at the DOE. As requirements and costs for supplemental capabilities identified in the NPR are determined, future budget requests may incorporate funds for such programs.

SCHEDULE FOR DEPLOYMENT OF NEW LOW-YIELD WARHEAD

30. Senator HEINRICH. Dr. Soofer, the W76 life-extension program is on schedule to be completed in FY2019, about 18 months from now; however, you stated the process to develop a new low-yield warhead must be part of the ongoing LEP and would take two to three years. Of course, work on a proposed new low-yield warhead has not been authorized and could well take longer than expected. What are the specific plans and time-line for the near-term modification required to provide a low-yield warhead before the W76 LEP has been completed as scheduled in FY2019?

Dr. SOOFER. Weapons development is managed through the Nuclear Weapons Council Joint Nuclear Weapons Lifecycle Process. Using this process, the NNSA believes it can achieve W76–2 first production unit (FPU) within 3–6 months after congressional authorization. Production for the W76–1 is ongoing. With congressional authorization, development engineering work can begin on the W76–2. NNSA will seek timely authorization. The W76–2 is not expected to adversely impact the current W76–1 production schedule, which is scheduled to be complete by mid-2019. Further details can be provided in a classified briefing.

SCHEDULE IMPACTS ON ONGOING LEPS

31. Senator HEINRICH. Dr. Soofer the national labs and sites have said they are as busy as they have ever been when considering the Life Extension Projects that are already underway and the ones planned in the future. What are the additional work and funding requirements for the proposed new low-yield warhead for a sub-launched ballistic missile?

Dr. SOOFER. DOE has sought congressional authorization to reallocate $65 million in funding within the DOE Weapons Activities account to support the low-yield ballistic missile recommended by the 2018 NPR. Because the W76–2 is a minor modification to the existing W76–1, there will be minimal workforce impact. At the time the FY 2019 Budget was transmitted to the Congress, the details of the 2018 NPR were still being developed, and were not ready for inclusion in the FY 2019 Budget.

DOD has requested $22.6m in FY 2019 and $48.5m across the Future Years Defense Program (FYDP) for Trident modifications that will qualify the missile to deliver low-yield nuclear weapons.

32. Senator HEINRICH. Dr. Soofer, have you considered the possible impacts on the existing schedule for the ongoing and planned life-extension programs and the additional costs and effort on top of all the other outstanding requirements across the complex?

Dr. SOOFER. Yes, I have. The Nuclear Weapons Council is focused on ensuring that NNSA's nuclear weapons activities are aligned and synchronized with DOD's modernization programs, and that it has the resources to execute these activities. We do not expect the low-yield ballistic missile to impact planned life-extension program schedules because it is a modification to the W76–1 currently in production.

UNCERTAINTIES IN FUTURE SECURITY ENVIRONMENT

33. Senator HEINRICH. Dr. Soofer, the NPR includes a discussion of uncertainties regarding the future security environment and the threats it may pose, including technological threats to the U.S. deterrent. Sandia National Labs, on behalf of NNSA, has specific capabilities to ensure the stockpile can withstand technological breakthroughs or the development of wholly new technologies. However, Sandia's and the other labs' threat experimentation capabilities are decades old. What is your perspective regarding whether the NNSA labs should be contemplating increasing their science and engineering capabilities to outflank unanticipated technological breakthroughs?

Dr. SOOFER. DOD and NNSA work together to conduct ongoing evaluations of the current and future security environments to ensure the United States remains at the forefront of science and technology and to reduce the likelihood of technological surprise. NNSA's national laboratories possess science and engineering capabilities that enhance deterrence and national security writ large. The NNSA laboratories have the capability to respond effectively to emerging threats, unanticipated events, and technological innovation. Continued support for and investment in these capabilities, including threat environment experimentation capabilities, at the NNSA National Laboratories is essential. The NNSA laboratories are also currently in the process of implementing the statutrory Stockpile Responsiveness Program to exercise these capabilities further with DOD coordination.

HYPERSONIC TECHNOLOGY

34. Senator HEINRICH. Dr. Soofer, I understand the Department is still in the process of building its Missile Defense Review, but I would like your assessment of where the NPR and the Missile Defense Review will converge around hypersonic capabilities of Russia. Noting that we are in an open session today, can you discuss with the Subcommittee what the Department's specific priorities are for hypersonic technology?

Dr. SOOFER. DOD takes the threat posed by offensive hypersonic weapons seriously. Hypersonic threats and technology development will be addressed in the Missile Defense Review (MDR). Recently, Under Secretary of Defense for Research and Engineering Mike Griffin made hypersonic technology/capability development his top technical priority. If a potential adversary gains an advantage in hypersonic technology, it could invite the mistaken impression that the United States could be coerced into not upholding its security commitments to allies and partners. We are concerned about our ability to characterize and defend against hypersonic systems. The Department is conducting a formal Analysis of Alternatives (AOA) that will characterize hypersonic weapon threats and identify alternatives for defending against them. This AOA is well underway and on-track to provide its final report by the end of this calendar year 2018.

QUESTIONS SUBMITTED BY SENATOR ELIZABETH WARREN

SEA-LAUNCHED CRUISE MISSILE

35. Senator WARREN. Admiral Benedict, I understand that no decision has been made at this point about where a low-yield nuclear SLCM would be deployed, but that the entire fleet is being considered. Can you describe what would be required to put nuclear weapons back on surface ships or attack submarines —in terms of manpower, training, security, and operations?

Admiral BENEDICT. The Navy, working closely with the Joint Staff and the Office of the Secretary of Defense, is evaluating requirements associated with the nuclear sea-launched cruise missile. Manpower, training, security, and operations are factors that will be part of the evaluation. Specialized training and certification will be required to ensure the safety and security of the weapons. The Navy successfully performed the mission associated with the nuclear sea-launched cruise missiles on surface ships and attack submarines for decades.

36. Senator WARREN. Admiral Benedict, both Secretary Spencer and Admiral Richardson have listed the Navy's readiness as one of their top concerns. Will the impact on readiness be part of the Department's analysis of alternatives?

Admiral BENEDICT. Yes. The Navy, working closely with the Joint Staff and the Office of the Secretary of Defense, is evaluating requirements associated with the nuclear sea-launched cruise missile. Specialized training and certification will ensure surface ships and submarines are adequately prepared for deployment.

37. Senator WARREN. Admiral Benedict, will putting nuclear weapons on attack submarines or surface ships require making new arrangements for port visits with U.S. allies and partners, some of whom have legislated specific requirements for the transit of nuclear weapons on or through their territory?

Admiral BENEDICT. We do not discuss the presence or absence of nuclear weapons on our vessels. The current policy of the U.S. Government is not to deploy nuclear weapons aboard U.S. Navy surface ships and attack or guided missile submarines. Our entry into another state's ports is subject to whatever conditions the foreign state may require. If there are new or existing restrictions that would apply to our port visits, we may need to request exemptions or negotiate new arrangements. However, the outcome of any negotiations with a particular state would be speculative at this point.

B83–1 RETIREMENT

38. Senator WARREN. Dr. Soofer, the NPR proposes to keep the B83–1 warhead until a suitable replacement is found. For how much longer can NNSA retain the B83–1 without performing an ALT or LEP?

Dr. SOOFER. As part of DOD's implementation of the 2018 NPR, we will review whether it is necessary to retain the B83–1 and for how long. NNSA can provide classified technical details pertaining to how much longer NNSA can retain the B83–1without performing an ALT or life-extension program (LEP).

39. Senator WARREN. Dr. Soofer, how would a refurbishment or life extension for the B83–1 impact NNSA's already aggressively ambitious program of work?

Dr. SOOFER. There is no current plan to seek a B83–1 refurbishment or LEP. If a decision were made to refurbish or life extend the B83–1, DOD and DOE would carefully coordinate to balance the competing demands on NNSA's infrastructure. A request for further specificity about what this would entail should be directed to NNSA.

40. Senator WARREN. Dr. Soofer, according to your previous public comments, the B83 is required to hold certain targets in North Korea at risk. What has changed about the North Korean threat that requires DOD to retain the B83; are there targets that cannot be held at risk by other weapons in the U.S. arsenal?

Dr. SOOFER. As a result of the significant and rapid worsening of the international security environment since the 2010 NPR, the Administration decided to postpone B83–1 retirement until completion of a 2018 NPR-directed study assessing the requirements necessary to meet policy and operational objectives, and if required, a suitable replacement capability is identified.